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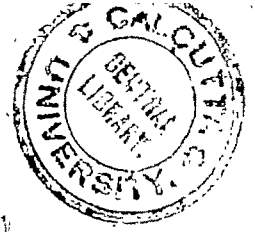ANTHONY SCOTT, Univ. of British Columbia

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PAPERS AND PROCEEDINGS

OF THE

Eightieth Annual Meeting

OF THE

AMERICAN ECONOMIC ASSOCIATION

Washington, D.C., December 28-30, 1967

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PROGRAM OF THE EIGHTIETH ANNUAL MEETING OF THE
AMERICAN ECONOMIC ASSOCIATION

Washington, D.C., December 28-30, 1967

Wednesday, December 27, 1967

12:30 P.M.

Executive Committee Meeting

Thursday, December 28, 1967

8:30 A.M.

Aggregate Demand Shifts, Labor Transfers, and Income Distribution (Joint session with the American Farm Economic Association)
  Chairman: VERNON W. RUTTAN, University of Minnesota
  Papers: HYMAN MINSKY, Washington University; DALE HATHAWAY, Michigan State University, and B. B. PERKINS, University of Guelph
  Discussion: W. H. LOCKE ANDERSON, University of Michigan; LOWELL E. GALLAWAY, University of Pennsylvania

Graduate Student Session (Joint session with *The American Economist*)
  Chairman: EGON NEUBERGER, State University of New York, Stony Brook
  Papers: MASAHIKO AOKI, University of Minnesota; JAMES C. MILLER, III, University of Virginia; RICHARD W. MONTGOMERY, Oklahoma State University
  Discussion: JOSEPH LICARI, Princeton University; MAHMOUD FOUAD, University of Idaho; JOHN DOMINGUEZ, University of Southern California

Transport for Economic and Social Development (Joint session with the Transportation and Utilities Group)
  Chairman: GEORGE W. WILSON, Indiana University
  Papers: PAUL O. ROBERTS and DAVID KRESGE, Harvard University; ALAN A. WALTERS, Massachusetts Institute of Technology and University of Birmingham, England; JAMES R. NELSON, Amherst College
  Discussion: GUSTAV RANIS, Agency for International Development; BENJAMIN CHINITZ, Brown University; ERIC SCHENKER, University of Wisconsin, Milwaukee

10:30 A.M.

Round Table on the Economics of Environmental Management
  Moderator: JOSEPH L. FISHER, Resources for the Future, Inc.
  Panel: JACK W. CARLSON, Council of Economic Advisers; M. MASON GAFFNEY, University of Wisconsin, Milwaukee; MORRIS E. GARNSEY, University of Colorado; LESTER B. LAVE, Carnegie-Mellon University

Round Table on the Economics of Higher Education
  Moderator: CHARLES KILLINGSWORTH, Michigan State University
  Panel: CLARK KERR, University of California, Berkeley; WILBUR J. COHEN, U.S. Department of Health, Education, and Welfare; ALLAN CARTTER, New York University; GERARD BRANNON, U.S. Treasury Department

Internal and External Labor Markets (Joint session with the Industrial Relations Research Association)
  Chairman: ARNOLD R. WEBER, University of Chicago
  Papers: JOHN F. BURTON, JR., University of Chicago, and JOHN E. PARKER, University of Michigan; FRAZIER KELLOGG, Massachusetts Institute of Technology; HERBERT NORTHRUP, University of Pennsylvania
  Discussion: JOSEPH ULLMAN, Purdue University; MYRON L. JOSEPH, Carnegie-Mellon University

2:00 P.M.

Measurement for Public Policy (Joint session with the American Statistical Association)
  Chairman: WILLIAM CAPRON, Brookings Institution
  Papers: ROBERT N. GROSSE, U.S. Department of Health, Education, and Welfare; How-

ARD W. HJORT, U.S. Department of Agriculture; NESTOR E. TERLECKYJ, U.S. Bureau of the Budget
Discussion: OTTO ECKSTEIN, Harvard University; EDWARD M. FOSTER, University of Minnesota

2:30 P.M.
International Liquidity
  Chairman: JOHN M. LETICHE, University of California, Berkeley
  Papers: ROBERT CLOWER and RICHARD G. LIPSEY, Essex University, England; RICHARD N. COOPER,[1] Yale University; ALEXANDRE KAFKA, University of Virginia; PETER M. OPPENHEIMER, Oxford University; GEORGES PLESCOFF, International Monetary Fund; FRANCIS M. BATOR, Harvard University; JOHN M. LETICHE, University of California, Berkeley
Behavioral and Ecological Economics
  Chairman: KERMIT GORDON, Brookings Institution
  Papers: GEORGE KATONA, University of Michigan; JAMES N. MORGAN, University of Michigan; RUTH P. MACK, Institute of Public Administration
  Discussion: PETER DE JANOSI, Ford Foundation; HAROLD W. WATTS, University of Wisconsin
Economics of Arms Control and Disarmament
  Chairman: ARCHIBALD S. ALEXANDER, U.S. Arms Control and Disarmament Agency
  Papers: EMILE BENOIT, Columbia University; MORRIS BORNSTEIN, University of Michigan; MURRAY WEIDENBAUM, Washington University
  Discussion: WILLIAM CAPRON, Brookings Institution; HOLLAND HUNTER, Haverford College

8:00 P.M.
Richard T. Ely Lecture
  Chairman: KENNETH E. BOULDING, University of Colorado
  Invited Lecture: JACOB MARSCHAK, University of California, Los Angeles

Friday, December 29, 1967
8:30 A.M.
Experiments in Teaching Economics
  Chairman: MARSHALL R. COLBERG, Florida State University
  Papers: ALLEN C. KELLEY, University of Wisconsin; RICHARD ATTIYEH, University of California, San Diego, WILLIAM C. BRAINARD, Yale University, and F. T. DOLBEAR, JR., U.S. Bureau of the Budget; CAMPBELL R. McCONNELL, University of Nebraska
  Discussion: MYRON L. JOSEPH, Carnegie-Mellon University; RICHARD S. BOWER, Dartmouth College; HENRY H. VILLARD, City College of New York
The Entrepreneur
  Chairman: ARTHUR H. COLE, Harvard University
  Papers: WILLIAM J. BAUMOL, Princeton University; HARVEY LEIBENSTEIN, Harvard University; JAMES H. SOLTOW, Michigan State University
  Discussion: EVSEY D. DOMAR, Massachusetts Institute of Technology; EVERETT E. HAGEN, Massachusetts Institute of Technology; ALEXANDER GERSCHENKRON, Harvard University

10:30 A.M.
Round Table on the Scientific-Military-Industrial Complex and the New Industrial State
  Chairman: EDWARD S. MASON, Harvard University
  Panel: WALTER ADAMS, Michigan State University; GEORGE J. STIGLER, University of Chicago; H. L. NIEBURG, University of Wisconsin, Milwaukee; SEYMOUR MELMAN, Columbia University
Round Table on the Grants Economy
  Chairman: MARSHALL A. ROBINSON, Ford Foundation
  Panel: KENNETH E. BOULDING, University of Colorado; JAMES M. BUCHANAN, University of Virginia; JOHN R. MEYER, Harvard University; JOSEPH A. PECHMAN, Brookings Institution

12:30 P.M.
Joint Luncheon with the American Statistical Association and the American Finance Association

Chairman: MARTIN R. GAINSBRUGH, National Industrial Conference Board
Speaker: MILTON GILBERT, Bank for International Settlements

2:00 P.M.

Econometric Models, Their Problems and Usefulness (Joint session with the Econometric Society)
   Chairman: JACOB MARSCHAK, University of California, Los Angeles
   Papers: WILLIAM C. BRAINARD and JAMES TOBIN, Yale University; ROBERT H. RASCHE, University of Pennsylvania, and HAROLD T. SHAPIRO, University of Michigan
   Discussion: CARL F. CHRIST, Johns Hopkins University; JOHN V. LINTNER,[1] Harvard University

2:30 P.M.

Technological and Economic Implications of 3 Percent Growth (Joint session with the Society for the History of Technology)
   Chairman: ROBERT L. HEILBRONER, New School for Social Research
   Papers: MICHAEL MICHAELIS, Arthur D. Little, Inc.; HENRY H. VILLARD, City College of New York
   Discussion: VICTOR FUCHS, Ford Foundation; JOSEPH L. FISHER, Resources for the Future, Inc.; BEN B. SELIGMAN, University of Massachusetts

8:00 P.M.

Presidential Address[1]
   Chairman: ARTHUR F. BURNS, Columbia University
   Presidential Address: MILTON FRIEDMAN, University of Chicago

9:15 P.M.

Business Meeting

Saturday, December 30, 1967
8:30 A.M.

Regional Economic Models
   Chairman: RICHARD RUGGLES, Yale University
   Papers: GEORGE H. BORTS, Brown University; WERNER Z. HIRSCH, University of California, Los Angeles; JOHN R. MEYER and JOHN KAIN, Harvard University
   Discussion: FRANK PUFFER, University of California, Los Angeles; SIDNEY SONNENBLUM, National Planning Association; GUY ORCUTT,[1] International Bank for Reconstruction and Developmet
Economics and Noneconomics of Poverty
   Chairman: MARTIN COHNSTAEDT, University of Saskatchewan
   Papers: WILLIAM H. COOPER, Bucknell University; ROBBIN R. HOUGH, Oakland University; RICHARD A. LA BARGE, Louisiana State University
   Discussion: JAMES D. SMITH, Office of Economic Opportunity; WILLIAM B. NEENAN, University of Michigan; HERMAN G. BERKMAN, New York University
Invited Student Dissertations
   Chairman: FRITZ MACHLUP, Princeton University
   Papers: DENNIS R. APPLEYARD, University of North Carolina; ROBERT M. COEN, Stanford University; MAURICE PFANNESTIEL, Wichita State University; JOHN O. LEDYARD, Washington University

10:30 A.M.

Economic Reform in Eastern Europe and the U.S.S.R. (Joint session with the Association for the Study of Soviet-type Economies)
   Chairman: E. E. HAGEN, Massachusetts Institute of Technology
   Papers: ROBERT W. CAMPBELL, Indiana University; GEORGE J. STALLER, Cornell University; BENJAMIN WARD, University of California, Berkeley
   Discussion: ABRAM BERGSON, Harvard University; JOHN M. MONTIAS, Yale University
Round Table on the Selection and Training of Foreign Graduate Students
   Chairman: HAROLD F. WILLIAMSON, Northwestern University
   Panel: RALPH K. DAVIDSON, Rockefeller Foundation; WYN F. OWEN, University of Colorado; ALBERT G. SIMS, National Association for Foreign Student Affairs; JAMES S. WORLEY, Vanderbilt University

12:30 P.M.

Joint Luncheon with the U.S. National Commission for UNESCO
   Chairman: WILLIAM H. NICHOLLS, Vanderbilt University
   Speaker: CHARLES FRANKEL, Assistant Secretary of State for Education and Cultural Affairs

2:30 P.M.

Problems in Pricing and Growth
   Chairman: ROBERT SOLO, Michigan State University
   Papers: C. S. SOPER, University of Melbourne, and L. R. WEBB, University of Melbourne and Cornell University; PAUL DAVIDSON, Rutgers University; HANS H. JENNY, College of Wooster
   Discussion: HAROLD WEIN, Michigan State University; ALLAN COTTA, University of Caen; ALEXANDER NOWICKI, International Monetary Fund

Nonmarket Decision Making
   Chairman: GORDON TULLOCK, Rice University
   Papers: WILLIAM A. NISKANEN, Institute for Defense Analyses; CHARLES PLOTT, Purdue University; JAMES M. BUCHANAN, University of Virginia
   Discussion: STEPHEN ENKE, TEMPO; OTTO A. DAVIS, Carnegie-Mellon University; EARL THOMPSON, University of California, Los Angeles

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[1] No manuscript received.
[2] Published in the March, 1968, *A.E.R.*

RICHARD T. ELY LECTURE

ECONOMICS OF INQUIRING, COMMUNICATING, DECIDING*

By JACOB MARSCHAK
University of California, Berkeley

We hear much of today's "informational revolution." We are also told of the rapid growth of the "knowledge industry." Informational revolution is exemplified by TV pictures of the moon surface and also by robotized stock market transactions and, hopefully, by computerized professors. Fritz Machlup defined the knowledge industry to include education and research as well as publishing and broadcasting. He estimated its share in the gross national product of 1958 at 23 percent to 29 percent, and its growth rate at about 10 percent, or twice that of the GNP. Projecting to the present, the share of the knowledge industry would then appear to straddle the 40 percent mark!

There is a suspicious overlap between these activities and those which Adam Smith and Karl Marx called "unproductive" and which include the work of kings and professors, none of whom add to the vendible and visible stocks of the nation. To be sure, recent analysis—for example, by T. W. Schultz and Carl v. Weizsaecker—found it both convenient and feasible to define human capital and thus to consider education as investment. But the notable fact remains that professors and kings or the modern equivalent of kings—managers, both public and private—are strongly involved in those trends: informational revolution and growing knowledge industry.

Professors and managers, but also computers and TV sets, are involved in still another trend relevant to my talk. A growing proportion of both manhours and machine-hours is not employed for using large amounts of energy (muscular or otherwise) to transform or transport matter. Instead, so-called "brains" (human or otherwise) are employed to manipulate symbols. A sequence or network of such symbol manipulators uses up a minute amount of energy to eventually release, trigger-like, large amounts of energy through the more brutal medium of generators, muscles, and machine tools. In a modern assembly or disassembly plant (sawmill, meat packing), a growing majority of people,

wearing white collars, or blue denims as well, do the brain work of inspecting, deciding, reporting—shunting, pushing buttons—and not the muscular work of shaping or carrying material masses; and a growing proportion of machines, called control mechanisms, are also busy with inspecting, reporting, deciding, and not with transforming or transporting matter and energy.

My topic is the economics of what I shall call the services of inquiring, communicating, deciding. Data are gathered. They are communicated to the decision-maker. He, on the basis of the message received, decides upon the action to be taken. A higher-order decision must have been made previously. Someone representing the interests of the economic unit considered—its head, leader, organizer—must have chosen a particular combination of these three services from all those available in their respective markets. The maker of this higher-order decision (the "meta-decider," sometimes called "the organizer") may happen to be the same person who will decide upon acting. Or more generally, the organizer will hire the services of the decision-maker—who, in appropriate cases, may be just a robot.

I might also call my topic the economics of the instruments, or devices, human or otherwise, for inquiring, communicating, and deciding. For it is not relevant, for my purposes, to distinguish between purchased instruments and hired services, provided the length of the hire contract is specified. In any case, I shall be concerned with symbol manipulators, human or otherwise, rather than with processors or transporters of matter or energy.

Here is what I plan to do. I shall present, in turn, from the user's point of view, the successive links in the sequence of symbol-manipulating services: inquiry, or data gathering; communication of messages; and deciding upon actions on the basis of messages received. It will turn out, in fact, that the link called "communication" must be broken into two distinct services: on the one hand, the service of "encoding and decoding" which, at the present state of arts and in the most numerous and socially most important cases, is best supplied by men; and on the other • hand, the service of "transmission" which is best supplied by inanimate equipment. As to the supply conditions of services of inquiry, or data production, and of decision making, I shall be able to submit nothing but crude illustrations, I am afraid. As to the demand side, economists will not be surprised that to make an economical—that is, optimal, efficient —choice the user must choose those links, or components, simultaneously (just as a manufacturer cannot choose between rail and road as means of bringing him fuel without making up his mind, at the same time, whether the fuel should be coal or oil). Hence, the jointness of demand for services of inquiry, communication, and decision.

To be sure, current engineering science finds it convenient to isolate

a pure theory of communication—a theory of efficient coding and transmission alone, essentially created by Claude Shannon and streamlined by Jack Wolfowitz. At the other extreme, statistical decision theory culminating in the work of David Blackwell leaves out the communication component and only analyzes, from the point of view of a perfect decision-maker, the optimal choice of inquiry, or data producing, services, also called "experiments." I shall later state the implicit tacit assumptions made in each case. If they are not satisfied, the user guided by those subtheories will have suboptimized. This is not to say that we ought not to break up a complex problem into subproblems, assuming them independent as a provisional first approximation. Given our human limitations, this may even be the optimal research strategy. It just happens that the economist is aware of interdependencies: he calls them complementarity and substitutability of goods. He is also traditionally permitted—as is the philosopher—to attack complexities with ridiculously simple examples in order to get directly to the general and fundamental.

Let me, then, go ahead with a simple example. I must decide this Thursday night whether to fly West next Saturday morning. Visibility and winds along the airplane's route the day after tomorrow will determine whether, if I do fly, I shall arrive in time for an important appointment or shall be killed in a crash. If I don't fly, I miss the appointment. But I cannot know what the weather will be. Instead, I may look tonight at the hotel barometer; or I may rely on the radio reports of other, more numerous and accurate barometer readings; or I may rely on the *Farmer's Almanac*. If the cost of these various services were equal, I would choose the one which gives data most closely reflecting (in some sense) the actual event I am interested in: the weather on Saturday. But perfection is costly, and I shall choose a service that is known not to mislead too grossly or too frequently, yet will be relatively cheap.

Take another example. A store's profit will be influenced by its inventory policy, given the actual future demand for its merchandise. Lacking the knowledge of this demand, the firm will have to choose between various services of market forecasters differing in precision and accuracy but also in the fees charged.

So much about services that inquire; i.e., produce data. These data are not identical with, yet do reflect in some sense the events that are relevant to, the result of a decision. Now, the decision-maker may or may not be able to obtain such data directly. Another service called "communication" will bring to him, not those data, but a message, possibly delayed or distorted, about those data. He must decide on the basis of such a message, which is now twice removed, in a sense, from the actual, result-relevant event: weather on Saturday, demand next month, and so on.

The inventory example illustrates also the nature of decision services.

Inventory policy is a rule stating whether and how much t(
when the stock at hand is at a given level and you have some-
imperfect—knowledge related to the prospective demand of ᶖ
tomers. One policy is similar to the one you use when you decide
to refill your car's oil tank up to a certain upper level (this yo
whenever oil is below a certain lower level) or to leave it alone
that in the inventory case the two critical levels themselves are
but should depend on what the store has learned—however impe
about future demand; that is, on the message it has received a
data produced by a market forecast. Such a decision rule or str
rule of how to respond to the message—may require the soph
services of a specialist or a computer. Contrast with this a sin
tine rule: to refill the inventory every Monday to a consta
This can be handled by an unskilled clerk or a cheap robot. 1
sophisticated, flexible, nonroutine rule would be preferable if it
for its higher cost.

To state more precisely the problem facing the user of the (
ducing, communication, and decision services, it is convenien
resent each service as a transformer of inputs into outputs.
former, transformation, and function mean essentially the sam
A data producing service such as a barometer is a transform
input is the result-relevant event (weather next Saturday) ar
output is an observed value, a datum (the barometer reading
We say that the data service is both precise and reliable if to ea(
relevant event corresponds one observation or datum, and co:
But this perfection is almost never attained. Generally, each ev
be reflected in various alternative observed values, with some
tives more likely than others. We have here the case of an "un
(probabilistic, stochastic, noisy) transformer. For example, supp
if Saturday's weather is going to be good, the chance that the b
shows high pressure tonight is 80 percent. We say that the likel
the observation "high pressure," given the event "good wea
80 percent. Suppose the likelihood of low pressure if the weathei
to be dangerous is also 80 percent. Suppose that on a second b
both these likelihoods are lower: 60 percent and 60 percent, saᶨ
have access to both barometers at the same cost or effort, you w
to be guided by the first one. For, in an obvious sense it is more
(more informative, in Blackwell's terminology). Indeed, in the
perfect reliability the two likelihoods would be 100 percent and
cent; and clearly our first barometer (with 80 percent, 80
comes closer to this perfection than the second (with 60 per
percent). In fact, the second comes closer than the first to the (
treme: likelihoods 50 percent, 50 percent, in which case the ba
would be useless.

rials of this kind his choices reveal a consistency of his beliefs
is tastes. Or perhaps such trials will gradually train him toward

tions. The probabilities of the results thus derived serve as weights to obtain the average of their utilities. This average may be called the ~~utility~~ of the given pair of data producing and

The Timing of Materials Buying

Think of inventory fluctuations as arising from two sorts of problems. The first concerns the amount of goods required for the efficient servicing of sales when buying is hand to mouth. The second concerns the short-term timing of buying in view of possible departures from hand-to-mouth buying. The ecological model is concerned only with this second set of problems dependent on a group of market-oriented judgments. It depicts how materials, both on hand and on order (call this "materials ownership"), may be expected to exceed or fall short of the amount required for the efficient servicing of sales under stable market conditions. This long or short buying is predicated on expected changes in materials prices, in the speed and reliability with which deliveries are expected to be made or quality specifications to be met.

Structure of the Model. The model is based on three sorts of characteristics of the situation: structural, behavioral, and environmental.

Structural characteristics are of two chief sorts: First, for each firm, the cost of holding stock on hand and on order increases, after some designated number of weeks' supply has been attained, at progressively and eventually at sharply, increasing marginal costs. In consequence, as Figure 1 shows (upper figure), market-oriented ownership for the individual firm approaches a maximum limit, which marks the outer confine of an area of option: the long-short market range.

Second, the potential benefit from attending to the timing of buying and altering, accordingly, the number of weeks' supply held on hand and on order, varies from firm to firm, depending on a number of characteristics of the materials that are used, the talents and assignments of the staff, and the specifics of the manufacturing and marketing operations.

This tendency for the proclivity to benefit from market-oriented buying to differ among firms implies a structural attribute of the industry as a whole: If the proclivity for each firm in an industry is rated from 100 to 0, it seems reasonable to hypothesize that very high ratings would be rare and frequencies would increase as some sort of medium sensitivity is approached; frequencies would no doubt start to tail off some time before the exceedingly low end of the proclivity range. The distribution, in other words, is mound-like as shown in the lower half of Figure 1.[1] This mounded frequency distribution of relevant attributes is basic in the sense that I must substitute it for the notion of the "representative" firm.

Behavioral characteristics concern the designation of the appropriate

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[1] The actual shape of the distribution needs, of course, to be studied. In some cases, for example, there may be no falling off at the low proclivity end. Only the low frequencies at the high proclivity end and eventual flattening of the slope are essential to my argument.

Ceilings to M-O Ownership
for a Firm

M-O
ownership,
weeks
supply

Rate of expected change in prices, etc.
or
assurance

Mounded Frequency Distribution of
Proclivity to Gain from M-O Ownership

Number
of
firms

100   0
Proclivity index for the unit
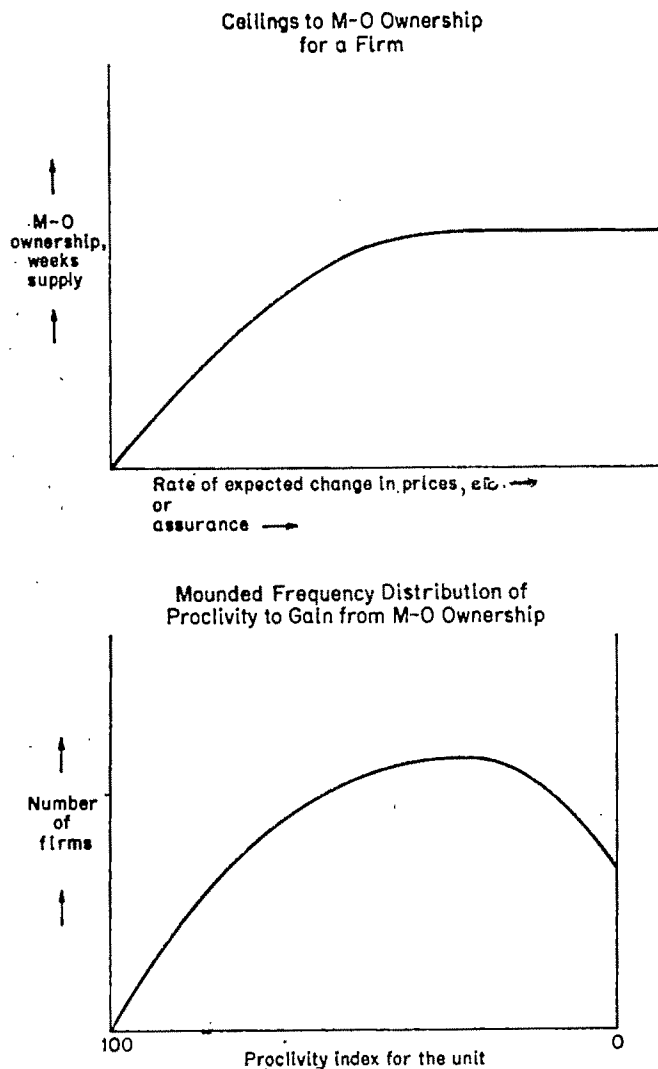
FIGURE 1

POTENTIAL GAIN FROM MARKET-ORIENTED OWNERSHIP

foci of attention,[2] how the decision unit learns about their present con-
dition (and how long this usually takes) and how the resultant action—
materials buying—relates to these market-oriented opinions. At any
given time, the level of ownership justified for a particular firm is de-

[2] Individual firms may be interested in prices or delivery periods or quality. However, the
confidence with which opinion concerning any one of these things will be held must increase as
evidence on all of them compound. These manifestations tend to move in the same direction at
the same time.

termined as a function of two evaluations—the expectation, however formulated, about changes in market conditions, and the assurance with which it is held. In the roughest sort of way this may be thought of as some most likely value and the expected range of deviation.[3]

A given expectation about changes in market conditions, held with a given amount of assurance, warrants a level of ownership position which departs from the physically efficient level by a given number of weeks' supply. The level that is justified is higher in the firm having a high proclivity than one having a low proclivity. If the present owner-ship position is less than the level that is justified, market-oriented buying takes place.

Environmental conditions are effected by the firms' market-oriented buying, positive or negative (as well as by the volume of buying for basic requirements). The model must specify what these conditions are, how they change, how knowledge of the change is conveyed to decision-makers and how long these things usually take.

Pattern of Change. The essence of the ecological process is the indi-vidual-environmental zigzag of information-action-impact-changed in-formation-new action, and so on. What is the pattern of aggregate temporal change that is thereby generated?

The answer can be visualized with the aid of a diagram of the firms' demand surface for a stock, market-oriented ownership. This surface would differ depending on the firms' proclivity to benefit, but any typical example will suffice. Figure 2 gives the rudiments. It relates desired ownership (vertical dimension) to the direction and extent of change in market conditions (horizontal dimension) and the confidence with which these "best guesses" are held (backward dimension). The long-short market range is the distance on the vertical axis from the front left corner to the back upper corner of the surface.

The amount of market-oriented buying which the industry under-takes at any given time is determined by the number of firms that act to add to or subtract from their level of ownership, when each move is weighted by the amount of buying which it entails. Thus, on the dia-gram, positive buying is a function of the number of firms that hop from a lower to higher level on their demand surface and the size of their hops.

When an expectation, say, of slightly tightening markets and rising prices forms, only firms having a high proclivity to benefit from antici-

[3] The most likely value may be simply a direction of change or a calculated "expected value" (an average of possible results weighted by their subjectively assigned probabilities). The range of deviation concerns the further value placed on, in effect, the peakedness of the probability distribution (kurtosis). I assume that a given expected value will result in more buying if the distribution has high rather than low kurtosis. This is all that is essential to the argument. However, I believe that the assurance dimension actually comprehends something more than kurtosis: a further judgment about how good and how stable the guess about all of these values really is. See Mack, *op. cit.*, pp. 281–82, and the bibliography there cited in note 13.
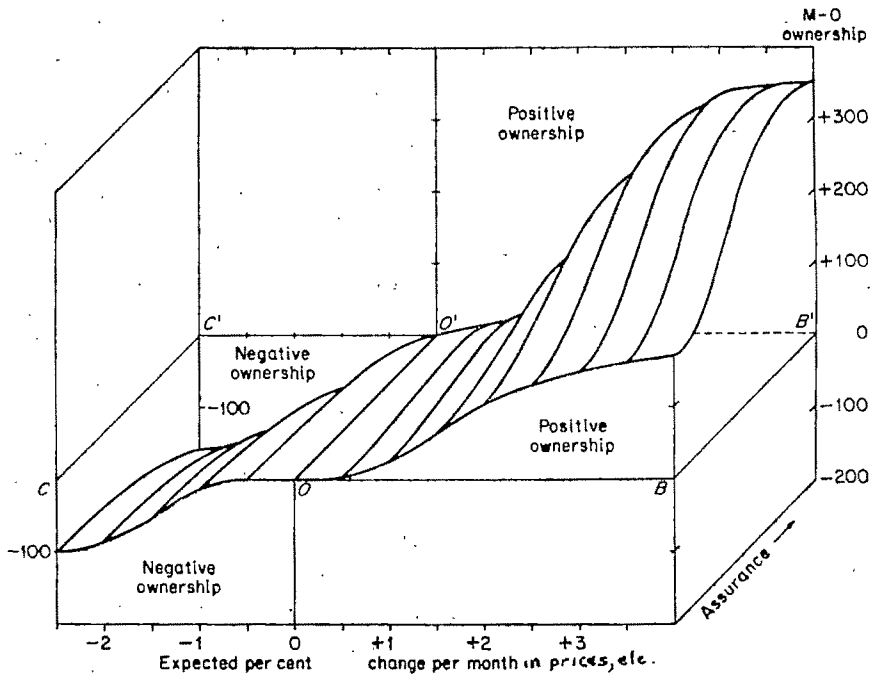
FIGURE 2

DEMAND SURFACE FOR MARKET-ORIENTED OWNERSHIP

pating market changes would move from the O point to the right on the ownership surface. To validate the desired change via ownership, additional buying would be undertaken. The buying, in its impact on suppliers and perhaps on market gossip, tends, other things the same, to support, and thereby augment, however minutely, the original optimistic expectations. If so, the next set of decisions about buying tend to be based either on greater assurance or on expectations of a somewhat stronger pickup. It would activate some of the next proclivity group of firms to undertake market-oriented buying and the higher proclivity group to extend their positions a little more.

I mentioned earlier that the time required for this triple response is an important input in the system. Note without further elaboration that each response is likely to be quite swift. Ordering of materials can be accomplished by a telephone call; materials markets respond sensitively to buyer-seller interchange; information about these responses moves daily if not hourly to purchasing agents whose decision about further buying is often relatively free of red tape.

If the underlying situation, plus the added stimulus of the market-oriented buying, continues to bolster optimistic expectations, the situation snowballs, as buying by firms in the lower proclivity but higher

frequency section of the distribution starts to be touched off. The environment responds in terms of further evidence of tightening markets; indeed the mere continuation of the same direction of change is likely to increase confidence in further rises, and thereby the buying associated with movement of desired ownership backward and therefore upward on the ownership surface. Other increases in desired ownership may result from changes in the nature of the competition that must be met consequent, for example, to widespread ownership of stock at low prices.

But the zigzag of expectation-action-environmental impact-new expectations changes its character when once the high-frequency portions of the proclivity distribution have been activated, and some of the earlier entrants have reached the upper end of their long-short market range. At this point the market-oriented buying wave passes its peak and the information feedbacks start to signal first doubt and then changed opinion.

Presently, the firms wishing to contract their ownership position increase; that is, they will wish to move forward or downward on the surface because of reduced assurance or expectations of lower rates of increase.

When retrenchment exceeds extension, the market-oriented group of factors actually exert a downward pressure on total inventories and thereby tends to bring on a downward phase of the inventory cycle as a whole.

I shall not stop to discuss the other half of a wave in materials buying. It is largely but by no means entirely symmetrical with the rising phase.

Implications of the Ecological Emphasis. First, the question that is asked implicitly insists that orders themselves be explained and not used as an independent variable. Orders are too nearly predated output for the former to "explain" the latter. Consequently, materials on order must be explained along with those on hand. And I am relieved to see that this conclusion is supported by Granger and Hatanaka's work with department store statistics and Thomas Courchene's with manufacturers inventories.[4]

But to follow the theory through to its logical implications, inventory change must be described by an equation system comprehending change associated with efficient servicing of sales, on the one hand, and with market-oriented buying, on the other. The latter, moreover, consists of three subsystems: an expression for the way in which buying is

[4] *Inventory Behavior and the Stock-Order Distinction: An Analysis by Industry and Stage of Fabrication with Empirical Application to the Canadian Manufacturer Sector,* Thomas Courchene (Dept. of Econ., Univ. of Western Ontario, Reprint No. 9). C. W. J. Granger and M. Hatanaka, *Spectral Analysis of Economic Time Series* (Princeton Univ. Press, 1964), Chap. 13.

associated with changed expectations; an expression for the impact of market-oriented buying on materials prices, deliveries, etc. (to which a feed-in from the efficient sales service part of the system must be added); and an expression for the impact of these signals on the new expectations of buyers.

This is complex. But worse, aggregate market-oriented buying is built up by touching off successive sections of a mounded frequency distribution, and influenced by an accumulating peaking of changes in expectations and the confidence with which they are held. Implied, therefore, is an aggregate of total materials buying which has a nonlinear relationship to sales or other usual economic time series. Put differently, the coefficients themselves change in the course of a buying wave.

Of course a mathematical formula can no doubt be found to describe historic data and meet statistical tests of reliability. The difficulty is that the meaning would always be obscure and its predictive value questionable. The logic gears into a micro, not a macro, scheme. To test the theory or to explain buying, or to formulate policy, it is necessary to learn whether reasonable values for the micro relationships and lags generate aggregate behavior of the sort observed. This seems to call for simulation.

Experimental and empirical study can help to determine the proper values for the chief parameters that need to be read into the simulation. They concern: length of the long-short market range; shape of the distribution of proclivities; coefficients linking action to expectations, that is, the desired ownership to the probability distribution of changes in market expectation; length of the firms' response lag; coefficient linking market reactions to firm's actions—market-oriented buying; length of the market reaction lag; coefficient linking buyers' expectation to market reactions; length of the information expectation and policy formation lag.

It is my contention that some set of reasonable values for these parameters incorporated in a stochastic simulation framework should generate a rising phase of ten to eighteen months, a turn, and a briefer falling phase, followed, probably, by an undefined period of doldrums requiring an exogenous influence to start off the next rise.

The duration of the endogenous aspects of the wave is a matter of focal interest. It is a function of the specifics of the processes and the length of the three lags. A different set of these specifics would apply to the cyclical timing aspect of the purchase of industrial equipment or consumer auto buying. Further knowledge concerning the nature and duration of these destabilizing elements in our economy should throw light on that increasingly interesting question: the prolongation of periods of business expansion.

Education and Economic Growth[5]

But ecological interplay can also be important in connection with final demand, where expectations are an important determinant of consumption and are themselves influenced by past consumption.

In the remaining pages I want to develop the thought that the same analytic elements used in the ecological inventory buying model help to explain the phenomenon of trend growth.

I shall concentrate on the role of education in economic growth. The important empirical studies by Gary Becker, Theodore Schultz, and Edward Denison have all found that education accounts for a very substantial portion of economic growth in this country.[6] It does so, they argue, by increasing the quality of labor input and thereby the amount of its output. Denison, for example, estimates that education accounted for .72 percentage points of the annual growth rate of 2.93 percent between 1929 and 1957.[7] Capital accounted for .45 points of the total. On a per capita basis, the role attributed to education is far greater still.[8]

But when the concepts of the ecological model are applied to the long-term contribution of education to economic growth, the conclusion emerges that education's role in economic growth ought not to be focused almost exclusively in its power to increase labor input. Nor should it be expected to exert the same influence for a given country over the years as among different countries at the same time.

Elements of the Model. The model requires an analysis in terms of frequency distributions of proclivities, and of the interplay between decisions and environment.

To get at both let me start with a list of the sorts of advantages and disadvantages that education of a specified kind may, implicitly if not explicitly, be expected to generate when a prospective student considers further schooling.

Advantages are the expected utility (adjusted for uncertainty) from: increased future earning power; improved amenities of living while at

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[5] This section borrows heavily from a background paper for a study of higher education in New York State undertaken at New York University with Allan M. Cartter and Robert Farrell.

[6] Gary S. Becker, *Human Capital; A Theoretical and Empirical Analysis, with Special Reference to Education* (N.B.E.R., Columbia Univ. Press. 1964); Edward F. Denison, *Sources of Economic Growth in the United States and the Alternatives Before Us* (C. E. D., 1962); Theodore W. Schultz, "Investment in Human Capital," *A.E.R.*, Mar., 1961, pp. 1–17.

[7] The figure for education was obtained by using information for 1949 concerning the difference in average earnings of people having specified years of schooling, assuming that three-fifths of these differences were due to education rather than to associated personal characteristics (characteristics that tend to parallel education-based groupings like ambition, ability, self-discipline, and the like, p. 69), and then applying these differences in earnings (and by implication in productivity) to the number of men, over the years, having specified number of years (hours) of schooling.

[8] The contribution of education remains the same—.72—but total per capita growth is 1.60 of which capital accounts for only .17 points.

the educational institution and thereafter on the job and in other personal and social relationships (these are often called consumption goods); miscellaneous advantages, such as getting away from the farm, hometown, and parents in the only acceptable way, avoiding military conscription, and so forth. Disadvantages (and note that these tend to be less chancy than the advantages) are the expected disutility from: direct costs of buying education; foregone earnings; the unpleasantness of study and the foregone pleasure in activity alternative to getting educated.

The amount of education that an individual will wish to acquire depends, first, on whether he thinks about it at all and, second, on his conclusions about the net advantage to be derived from the additional years of schooling which he is willing to consider. At some point, the contribution of additional years will appear to decline and even perhaps cease. (We all turn eventually from formal to on-the-job education.) Thus the individual's demand schedule for cumulated years of schooling will be a curve roughly similar to that in the top figure of Figure 1. Years of education are now on the vertical axis and expected net advantage of additional years (increasing to the right) on the horizontal axis.

How about the counterpart of the lower figure—the proclivity to benefit from investment of time and money in education?

Since the ecological interplay takes place between a set of decision-makers and their environment, it is useful to structure the analysis in terms of decision-makers defined as concretely as possible. Ergo, let us confine attention to one sort of decision: whether to go to college, on the part of the people who are of an age to consider the question.[9]

At one end of the proclivity array are the thirsty learners who crave information and the opportunity to put it to work; they are energetic and ambitious economically and socially. At the other end are the people who have little capacity to imbibe book learning and less interest in it; they do not have much faith in education as a way to improve earnings or amenities and the opportunity costs in terms of employment and other activities are high. In between are the areas of intermediate values. The frequency distribution of young people would presumably have some sort of mounded shape. The particulars depend on the time and the society. But proclivities at the high end of the array are neces-

[9] The relevant age group is clearly broader than simply the boys and girls of college entrance age, since the decision to go to college starts to get made much earlier—certainly anytime after the legal compulsory school age, and in many ways long before. However, we want to count in the frequency distribution only the average number at any given time who confront the actual decision to go or not to go. Think of this, for convenience, as the average number of 17 to 22 year olds (though many of them would actually have prepared the decision when younger). The statistics in Chart I use the shortcut of a single year of age since the effect on the trends is insignificant.

sarily less usual than for the more intermediate values, as also are, at least in many cultures, the very low values.[10]

The actual decision to invest in schooling at a specified level (insofar as it is not a matter of law) involves a reading of the evidence, on the part of each age-eligible person, concerning whether an A.B. will, and how surely, produce rewards in excess of all costs. The expected rewards may be shown increasing to the right on the counter part of Figure 2, with the confidence with which they are held increasing backward. The percent of age-eligibles opting for college are then shown on the vertical axis. And the demand surface slopes upward to the right and backwards as in Figure 2.

Change in the number of entrants (as a percent of eligibles) depends on changes in expected advantage and in the area of the proclivity distribution that is thereby touched off.

Is it likely that these two determinants of the desired level of education will change from year to year in a fashion tending to increase the proportion of age-eligibles acquiring a particular sort of education?

First, how are the readings of advantages from acquiring education likely to change? Start at a point where most people expect a level of advantage calculated to touch off the distribution of proclivities at a point well below its maximum frequency. Then a given further change in expected advantage will tend to activate enrollment on the part of a larger percentage of the age-eligible people.

If such an increase in the general estimates of advantage have taken place and, as a result, a larger enrollment has occurred, the additional number of college students will have some impact on the decisions of the students of tomorrow. One prompt effect may be in the penalty for not going to college; your friends are all there. Fed back to next year's decision-makers, this changes particularly the amenities. When new cohorts leave, there will be an effect on the job market; they will seek jobs for which education has hypothetically suited them. This, in association with the character of the distribution of jobs that are available, has an influence via earnings, and opportunity costs of jobs foregone. Later, there will be the influence which siblings have on one another, and particularly parents have on their children; this has potentially a powerful impact via the amenity group of advantages and disadvantages.

With varying lags, then, one of which spans a generation, the impact of individual decisions on the environment plays back to the new cohorts of decision-makers. The net effect of the endogenous ecological

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[10] In an undeveloped country the low end might be the thickest part of the distribution partly because most people do not think of even primary education as "for me."

interplay is to increase the reward expected from education or, equivalently, the penalty expected for not having it and penalties may be surer than gains. Ergo, as time goes on, providing the proclivity distribution itself does not change, the cluster of new decisions take place at points further and further to the right and backward on the demand surface.

But there are changes also that originate outside the model. The expectation of higher earnings must look to the jobs available. The fulfillment of expectations concerning earnings will depend upon the relationship of two frequency distributions: job seekers by educational attainment; jobs offered by educational prerequisites (assuming, to simplify, that an array of jobs by educational prerequisite and pay are identical).

If the job structure changes in a fashion which fulfills expectations, the advance, over time, to the right and backward on the education surface will be supported, at least insofar as it is sensitive to expected earnings.[11] But the rate at which college entrants (as a percentage of age-eligibles) increases would tend to slack off as the action eventually starts to concentrate in areas of the education demand surface where people of low proclivities (in decreasing density) tend to be found or where the surface itself has flattened.

I have argued thus far as if the frequency distribution of proclivities to benefit from a given type of education tended to remain constant in a given society. But of course this cannot be so. In 1910, the proportion of the age-eligibles with a high school diploma was about the same as for Ph.D.'s (plus other advanced professional degrees) today—about 8 percent. The same figure—8 percent—was attained for bachelor (plus first professional) degrees in 1940. By then about half of the age-eligibles had high school diplomas. Now the proportion is about three-quarters. Certainly, the entire conception of a high school education was altogether different when it was a badge of an elite 8 percent of the age group compared with what it is today when failure to have it stamps a young person as unworthy of being a file clerk.[12]

Society, in other words, changes the basic framework in terms of which all people gauge the advantage of a particular sort of education. This necessarily changes the shape of the frequency distributions of proclivities as well as the content of the benefit. Schematically this

[11] Note that the two distributions must change in a highly particularized fashion to justify Denison's assumptions about an income differential per year (hour) of schooling which is constant over the years (see note 6 above).

[12] It is suggestive in this connection that the proportion of high school graduates who later graduated from college was higher in the first decade of the century than it is today—about a third then, compared with a quarter now.

means that Figure 2 requires an additional dimension; the surface shifts as the decades roll by.[13]

Implications Concerning Education and Growth. What, then, does this ecological model suggest about the role of education in the measurement and analysis of economic growth?

First, how should the history of enrollments in this country be interpreted? In Chart I, this history is pictured in terms of the percentage of age eligible people receiving two sorts of academic certifications—high school diplomas and bachelor (or first professional) degrees. The chart shows sigmoidal growth in the rate of increase.[14] The shank of the growth curve, the areas where the rate was approximately constant, was long—from 1890 to 1940 for high school diplomas and from about 1915 to 1960 for baccalaureates; before and after, the rates of growth appear to have been slower. The explanation of the slower rates seems relatively simple. In the early phases, though the numbers receiving certification increased at a rapid rate, the participating groups were too small a proportion of the whole eligible group to increase the overall participation rates very substantially. At the other end, the fact that the increase in the rate of participation eventually slows down is also obvious in view of the absolute limit of 100 percent and the mounded shape of the proclivity distribution.

The more interesting question concerns why the constant rates

[13] For the ownership model a similar possibility was noted in R. P. Mack, *op. cit.*, p. 287, "as time goes on, there is a fifth way in which the situation matures. It involves the objective facts with which firms are faced; the need for defensive action increases. . . . Consequently, the *action* based on a given set of expectations, held with a given degree of assurance, increases. Diagrammatically, the surface as a whole rises." However, in connection with trend changes in education the shifts in the surface are probably of much more significance than in connection with cyclical changes in market tensions.

[14] Many economists have observed a tendency for growth rates to retard and have proffered explanations. Arthur F. Burns fitted a logarithmic parabola to the growth histories of 142 American manufacturing industries. His explanations of industrial retardation include many of the elements I have mentioned (including, implicitly, a mound-shaped distribution of proclivities, p. 127) and many I have not mentioned (*Production Trends in the United States since 1870*, N.B.E.R., 1934, Chap. IV). C. F. Roos and Victor Von Szeliski, in *The Dynamics of Automobile Demand* (New York, 1939), found that if economic influences were held constant, adjustment to maximum automobile ownership level had the pattern of a logistic curve. Zvi Griliches reported on the cumulative and retarding process whereby hybrid corn was taken over by American farmers ("Hybrid Corn: An Exploration in the Economics of Technological Change," *Econometrica*, Oct., 1957). His empirical study included many interviews, as, also, did those of Edwin Mansfield, who examined the introduction of a number of major technological changes in manufacturing. He has found that logistic curves seem to apply (see, particularly, *Technical Change and the Rate of Imitation*, Grad. Sch. of Ind. Admin., Carnegie Inst. of Tech., Reprint No. 89, 1961) and *Intrafirm Rates of Diffusion of an Innovation* (Cowles Found. Paper No. 206, 1964). Mansfield emphasizes the combined impact of increasing information and decreasing risk with a finite total absorbtion potential. Andrew D. Bain, in his work on the television industry, points to a tendency for positive skew to be present and argues in favor of fitting a log-normal rather than logistic curve (*The Growth of Demand for New Commodities*, Cowles Found. Paper No. 196, 1963). His explanation features the character of the learning process and the types of lags that it entails (p. 287).

CHART I

HIGH SCHOOL AND COLLEGE GRADUATES AS A PERCENTAGE OF AGE-
ELIGIBLE POPULATION
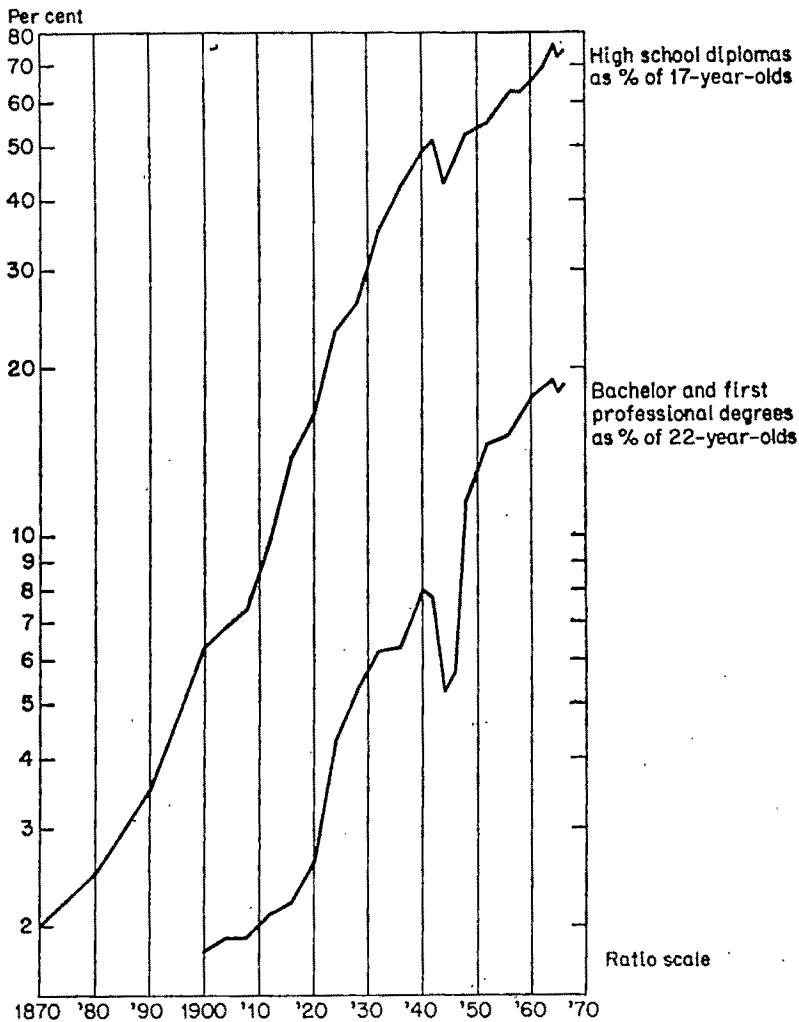
of growth continued for as long as about half a century. Note that a constant rate of rise over the years implies persistently increasing numbers of every, say, 1,000 17-year-olds gaining their diplomas. For a while, of course, the added demand for education takes place in the areas of increasing frequency of the proclivity distributions. The problem is, rather, how to explain the durability of the constant rate of growth. Explanation in terms of "learning"—the fundamental notion often used to explain sigmoidal patterns of growth—does not seem

DISCUSSION

PETER E. DE JANOSI: That consumer anticipations are a force to reckon with is not a controversial proposition. Equally, there is great unanimity that it has been Katona's important role to identify the relevance of consumer attitudes and intentions, to place them into a theoretical framework and to develop empirically quantifiable variables for their measurement. Indeed, so much of Katona's professional work has been devoted to these subjects that if a free-association test was to be administered to members of the economics profession, a vast majority would say, I hazard to bet, "Katona" when given the key words, "consumer attitudes and intentions."

Such close identification between subject and man is a two-edged sword, and both its drawbacks and advantages are illustrated in his paper, which is designed to restate the theoretical bases of the "psychological school of economics" and offer empirical findings. On the one hand, the paper exhibits Katona's mastery of survey data on consumer behavior and shows his ability to derive subtle and challenging conclusions from this material. Witness his sophisticated discussion of the relationship between the impact of consumers' financial progress and income expectations and durable-goods spending. Yet the drawbacks become apparent elsewhere; e.g., in the section entitled, "Understanding and Predicting Changes in the Demand for Durable Goods." Here Katona's own deep involvement with research may have caused him to neglect important research done by others—Tobin, Ferber, Juster, Mueller, Adams, to cite a few—that has carried both the theoretical and empirical research further than we are given to understand. Thus, one no longer does justice either to Katona's contribution nor to those of others to limit the discussion to the famous Index of Consumer Sentiment in simple aggregative terms. The overall relationship between the index and consumer durable-goods spending has often been shown, and the basic proposition that both ability and willingness to spend are important has become part of the economic literature. The revolution spearheaded by Katona has been won, and the need now is not only for detailed research that builds on, and extends, the many findings supporting the revolution but also resolves some of the conflicting and at times negative results.

The main propositions of the adaptive theory of consumer behavior which Katona finds most useful for his research come from general psychological and social psychological theories. It is difficult to assess the extent of agreement or disagreement which could be found among psychologists with these theories, but superficially the propositions sound sensible enough. Yet granting that consumers have rising aspirations, learn from others, and are often less than fully rational must by no means imply that all traditional economic theory of consumer behavior must be discarded. Does this not depend on what explanatory powers the two—according to Katona, conflicting—theories have? Thus, for example, Katona has over the years, by using the adaptive theory, greatly enriched the economists' understand-

ing of consumer behavior. At the same time the recent study of consumption by Houthakker and Taylor, by building entirely on propositions from traditional economic theory (though naturally also extending them), has surely also made a lasting contribution.

By raising this issue one comes uncomfortably close to the quicksand on which even the sturdiest methodological discussions are erected, and I am hesitant to pursue this line much further. Let it therefore simply be noted that it is not clear that all basic propositions underlying the adaptive theory are logically in contradiction with traditional theory. Must, for example, habitual behavior necessarily be not rational or optimizing? Could the generation of new wants and improvements in the standard of living not be incorporated into traditional though dynamic theory? Does not the adaptive theory also require notions of optimization; that is, the establishment of goals, albeit flexible ones, and the choice of an alternative with respect to the current set of objectives?

Apart from the above general comments, I have only two minor points to raise. First, it is probable that the almost exclusive emphasis on durable-goods spending as illustrative of discretionary purchases was more appropriate fifteen or twenty years ago than now. It might, for example, now also be fruitful to look at selected expenditures on services that possibly are just as discretionary, postponable, and large (e.g., vacations) as durables. Second, it was surprising to see how low the "adjusted" proportion of families was who have had past favorable income experiences and also expect further income increases (Table 1). With continued productivity increases, widespread union contracts, the general wage experiences of the past twenty years, and rising social security payments, would it not be reasonable to expect that a larger percentage of these families would actually turn out to have higher incomes during the coming four years? It would be interesting to know what the impact of such favorable surprises might be on their actual spending and saving.

Ruth Mack in her paper also expects to go beyond the conventional theory by seeing economic behavior as part of a dynamic process in which changes in expectations and goals occur as a result of changes in the environment. But her argument is not convincing that "information-action-impact-changed information-new action" needs a new term—"ecological" —and could not be described as "dynamic." There is undoubtedly much potential in her approach (as the discussions of the inventory process and of education clearly demonstrate). But is it not in many respects consistent with a dynamic extension of existing theory? Clearly, economists must recognize that sequences across time and the development of expectations and goals are important, and there is a need to understand economic dynamics, but new labels on old bottles of wine will not be of much help.

Morgan's paper is ambitious and deserves more attention than can be given to it in the remaining space. Nonetheless, two of his main topics should be commented on: the supply of labor and the measure of well-offness. Morgan finds that it is virtually impossible to identify a single

schedule for the supply of labor and that there exist many schedules with families tending to shift from one to another as their economic productivity and living standards rise. It is regrettable that Morgan did not consider in this connection the related though "nonsurvey" research by Bowen and Finnegan, and Mincer, concerning factors influencing labor-force participation. Incidentally, the evidence (however circumstantial) seems important that a family's real wage has to be well above some sort of national average threshold before significant disincentives to work appear. If correct, this finding has considerable bearing on the current arguments about the impact of the various negative income tax proposals on a family's work effort.

Whether there is or is not agreement with Morgan's proposed measure of well-offness, there is little doubt about the inadequacy of existing other measures of welfare. The kind of social indicators that have been recommended seem more diffuse, more difficult to aggregate, and less clearly definable than Morgan's index. His discussion, however, is marred by an apparent uncertainty whether the proposed measure identifies trends in well-offness or whether it diagnoses poverty. It probably would be helpful to both, though my guess is that it would do a better job on the former. Naturally, whether society can and will agree on a single measure of well-offness is an open question, but without such agreement it would remain an academic exercise with little policy relevance.

HAROLD W. WATTS: Katona's paper contains many valuable suggestions for approaches to improving our understanding of consumer behavior. It suffers from excessive beating of a nearly-dead horse—one that has been weakened from much use and abuse but which lacking a sturdier mount, must be continued in service. It is helpful to recognize the coordinate importance for behavior of both "environment" and "personality"—or, equivalently, the relatively objective situation in which behavior takes place, as well as the whole bundle of experience, information, and orientations, which a behaving unit brings to a situation. But it is misleading to imply that the traditional theory fails to recognize the importance of preferences, however poorly that theory may have explicated their more basic determinants.

As Ruth Mack's paper demonstrates, it is possible to elaborate more conventional models to accommodate interactions among individual behaving units, or between aggregates and their components; and this does not require any renunciation of simpler and cruder formulation and the partial insights they have provided.

Again, wants are not static—or at least preference structures of behaving units are not. We need to know much more about how they evolve, and we need more creative and sophisticated theorizing to organize our search for such knowledge. But discussions at the level of vagueness implied by terms such as "new wants," "pressing wants," "feeling of saturation," etc., do not meet the need.

We can, in short, generate theories of purposive adaptation within the vocabulary and framework of traditional economic theory, and avoid the

cost of unfamiliar—and, I fear, rather clumsy—new concepts incurred by abandoning that framework.

It is hard to take exception to the belief that "an adequate view of consumer behavior can be obtained only by considering principles of social learning and expectational dynamics. . . ." But other principles must be accommodated as well, and this must be done within a framework that is explicit enough to permit one to know whether he has a theory or a tautology. In these respects I find Katona's paper unsatisfactory. The many stimulating suggestions and ideas should either be incorporated into a more conventional framework, which is both possible and I think desirable, or grounded in a more complete and explicit alternative. Purposive adaptation is a strategy open to economic theorists as well as consumers.

Turning to Morgan's paper, I find it unfortunate that a very important idea is sandwiched in the middle of a paper with three quite separate objectives. The discussion of findings consistent with a negatively-sloped supply curve of productive effort, and the brief description of the projected panel study are both interesting, and each could have borne more extensive treatment. But the suggestions for improving our measures of well-being are much more exciting both for their conceptual content and their promise of applicability. I hope Morgan will carry this work forward and furnish us with a more refined concept and a means of obtaining practical measures of it.

Our understanding of phenomena such as inequality or poverty is severely restricted by the measures we apply, and our choice of policies to reduce or eliminate poverty are conditioned by that understanding. It is important, then, to measure economic status of families or persons by their command over real resources, including time, as distinguished from their particular (and often peculiar) allocation of those resources. Morgan's proposal to multiply a comprehensive measure of net income flows (money and nonmoney) on an "adult-equivalent" basis by a similar index of time available for leisure activities is very well suited for this task. This measure, more than others I am aware of, provides a close approximation to the "budget constraint" which limits the choices of households. It is, however much conditioned by past choices of the individuals involved, a magnitude that is predetermined relative to current decisions.

Morgan has not specified the period of time over which these income and leisure-time flows are to be measured. This is an important feature of any measure which is capable of substantial fluctuation when measured over short periods. We have an intuitive notion that economic status does not fluctuate on a week-to-week basis, but the fact that many components of an empirical measure of that status will fluctuate usually requires us to average over a relatively long period. It has been suggested that a year is too short a period for such measures, and some would average over a life-cycle.

Again, Morgan's recommendation that we use a relative measure of poverty, e.g., the number below some fraction of the mean value of economic status, is important and full of implications for choices among anti-

poverty policies. I can only express my concurrence in the recommendations and urge wider consideration of the issues involved.

Ruth Mack's excellent paper is an outstanding example of the kind of elaboration of theory that will be needed, or so it seems to me, to make further progress in understanding economic phenomena. Even if our ultimate concern remains with measures of aggregate and/or average performance, we cannot rely on models which operate primarily at that level. As both Mack and Katona have argued, there are interactions between aggregates and components which depend on the composition of any aggregate change.

But we must follow Mack into somewhat unfamiliar territory to develop theories that incorporate these effects. And we must also be prepared to test and refine these theories at the microeconomic level as well as at the aggregate level, for the simple reason that there will never be enough information left in aggregated data to discriminate among hypotheses and estimate relationships of the sort generated by Mack's inventory model.

I can only applaud Mack's effort in this respect, and urge others—including myself—to consider further applications of her basic structure as well as other ways of bringing more of the richness available in microanalysis into our aggregate models.

THE ENTREPRENEUR

INTRODUCTORY REMARKS

By ARTHUR H. COLE
Harvard University

After living with the subject of entrepreneurship for twenty years, which embraced a decade of almost interminable argument at the Research Center in Entrepreneurial History at Harvard, I venture to assert that progress in linking entrepreneurship and economic processes requires the closest attention to the relations of the single entrepreneur or an entrepreneurial group to a business unit or complex of units. The institutional model must contain strands permitting the transmission of effort into concrete action.

The dominant features of the institutional model may perhaps be most readily elucidated through the formulation of a series of related propositions. I offer such a series herewith if only as an earnest of the willingness of some historians to try to meet the principal concerns of economists at least halfway.

In doing so, I do not wish to imply that papers to be presented at this session and any subsequent discussion need be confined to the themes here formulated.

Proposition A. Like doctors and scientists, entrepreneurs have benefited over the centuries and decades from the almost continuous inflow of knowledge which has derived from many domestic and foreign sources, while they have improved their own technical situation by entrepreneurially generated vehicles for the transmission of contemporary data. On the basis of the literary remains of past generations of American businessmen, I ventured twenty years ago to posit a rising succession of entrepreneurial types as obtaining over the decades, successively: rule-of-thumb, informed, and sophisticated. No one has since that time risen to challenge the validity of this sequence, but now I would add a fourth stratum of evolution; namely, mathematically advised.

For the present discussion, I would merely suggest that such a heavy fertilization of the area of business could hardly fail to generate in a thousand ways an enhancement of the national income over the decades.

Recognition of the foregoing circumstances offers the sequence of acknowledging book publishers, editors of business periodicals, and the

like as equivalent in influence to investors and financiers in the pro-
motion of economic growth. At present, even the names of James H.
McGraw, Henry Varnum Poor, and Arch W. Shaw will fail of notice in
economic histories. And here it is pertinent to note that such men were
entrepreneurs in their own right.

Proposition B. "The entrepreneur" has for economic analysis some-
thing more than the possession of particular intellectual or emotional
qualities and the tendency to perform certain roles relative to other
members of society. As already intimated, he has attachment to one or
more specific business units which he may be conceived to have ini-
tiated, and to be attempting to maintain and, if possible, to aggrandize.

The efforts toward aggrandisement may take divers forms. The
entrepreneur rarely holds long to the concept of success that lured him
into initial action. He is moved by his ever expanding knowledge of the
total situation surrounding him, to modify his primary objectives, thus
fitting action of his enterprise more closely to the requirements of the
economy. In this connection Hastings Lyon's growth principle of
"trading on the equity"—which can be extended logically from finan-
cial to marketing and other areas of entrepreneurial activity—may be
invoked. Efforts to maximize the possibilities of the surrounding en-
vironment is as important here as in the growth of plants. Availability
of capital or labor is of secondary importance. The summations of such
adjustments through time, therefore, offer the probability of enlarge-
ment to the national income.

Again, the particular business unit may participate with other quasi-
affiliated concerns such as builders of its apparatus or the marketers of
its products in circular forms of interaction, as when modifications of
old or new machinery, the better to serve the manufacturing enter-
prise, are worked out in collaboration with its machine builders.

Proposition C. The manner in which the entrepreneur or his adminis-
trative group performs is—and always has been—shaped by the ideas
currently dominant in the circumambient society—religious, moral, po-
litical—but within such bounds a characteristic action of entrepreneurs
in a dynamic economy savors of or reflects innovations. Such new modes
of action extend much beyond technological improvements; they in-
clude new methods of technical business procedures, new modes of
advertising and selling, new ideas of employee or public relations, and
the like. And such innovations, initiated by the more progressive mem-
bers of given sectors of the business world, are (and must be) imitated
by the competitors of the latter, thus tending to raise the level of per-
formance of such sectors—and indirectly that of the whole business
order. If changes in business procedures and practices were patentable,
the contributions of business change to the economic growth of the

nation would be as widely recognized as the influence of mechanical inventions or the inflow of capital from abroad.

Proposition D. One specially significant avenue of innovation within this whole business order is that of institutional improvisation: the launching of a congeries of business units. Here one needs to take into account novelty of spatial location, extensions of action among units of a single business function (such as those of manufacturing or banking), and the creation of new functional enterprises (as when, at one time or another, commercial banks, advertising agencies, investment trusts, equipment lessors, and a thousand other types of business units were initiated).

This "division of labor" has resulted in the end in the creation of a business system which has possessed the specific nature of being the creature of socially stimulated, if entrepreneurially engineered, forces, one that renders mutual support and mutual advantage as among business units in variant functional groupings. Here, also, as in the competitive consequence of innovational action, there seems to lie the possibility of specific effect upon the course of economic change. Indeed, when the introduction of the functionally pertinent institutions of credit extension has occurred, it may be permissible, in imitation of the ideational pattern of Schumpeter's "Theory of Economic Development," to conceive of new functionally deviant groups of institutions being persistently created; some of these types of enterprise founded on entrepreneurial speculation will be found to be useful to the rest of the business community; and the institutional expansion of the business net may be credited with contributing much to the increase in total national income. Thus, incidentally, the "division of labor" may be viewed in this degree to account for the "extent of the market," not the contrary relationship hallowed since 1776.

Proposition E. Analysis of the business world reveals the existence of numerous endemic or built-in modes of action or reaction, which are in themselves sufficient to explain economic growth, especially if a place is made for existence and change in the external, conditioning, or parametric world of thought and institution, with the potentiality of business reaction to such a conditioning environment—a broad sort of public relations.

Accordingly it may appropriately be questioned whether there is not a place for a set of generalizations linking business life and practices with economic results, even as the organization and procedures of armies may be the proper study of one segment of political life or one mode of envisioning political aggrandizement.

Proposition F. As a sort of special case, it may be remarked that the "backwardness" and—in other circumstances—the forward progress

ECOLOGICAL PROCESSES IN ECONOMIC CHANGE: MODELS, MEASUREMENT, AND MEANING

By RUTH P. MACK
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In the biological sciences, ecology is defined as "the relation between living organisms and their environment." Here I apply the biological notion to the word on the next line of *Webster's New World Dictionary*, economic.

Processes of economic change often involve continuous interaction between the individual or firm and relevant aspects of the environment. The firm's decision is influenced by advices concerning environmental conditions; the resulting actions of the firm affect the environment; advices concerning these impacts tend to influence the next round of decisions.

This ecological interplay has often been featured in economic discussions, though without the label. Examples, to pick at random, include the "band wagon effect," investor "moods" of optimism or pessimism, the "take off" point and a host of other aspects of development theory, the diffusion of new products or innovations, some aspects of multipliers, and so on.

But though the interplay between the decision unit and environment has been extensively noted in economics it does not seem to have been the focus of specific analysis. An interesting example of such analysis in another field is the Reed-Frost model of epidemics and related subsequent work with a pedigree of half a century.

Ecological processes in economics are, I hypothesize, usefully conceived in terms of a number of standard elements which I shall describe. When the particulars are specified for some class of economic manifestation, the ecological aspects of the process appear to have a natural and inherent pattern of temporal change; the pattern can be a cyclic one of some particular duration or it may be that of an irreversible time trend of a generally sigmoidal shape. I shall have time to discuss only one cycle generating process—an aspect of inventory fluctuation— and one trend process—the role of education in economic growth.

The fundamentals of the model were developed in the last chapter of my recent book, *Information Expectation and Inventory Fluctuation; A Study of Materials Stocks on Hand and on Order*. It was introduced in order to explain very strong cyclical shifts in materials held on order which were not comprehended by the usual acceleration models.

this chicken-egg sequence. But at least we shall be studying the dynamics of success rather than the statics of failure.

In the case of some kinds of findings the policy implications of such a study are clear. If we find that a large number of those who stay poor over many years would have stayed poor no matter what they did, then the argument for negative income tax, or guaranteed minimum income without requirements as to behavior, residence, relatives, or "no-savings" becomes cogent. If we find certain kinds of attitudes and perceptions more adaptive than others, we can ask how to transmit them to more of the poor. If we discover certain common kinds of behavior that increase difficulties, such as refusing to try a job in a new area, for instance, or sheer unawareness of opportunities or disbelief in the relevance of new paths to success, perhaps an educational program can reduce the tendency to act that way.

Conclusion

To summarize, we need better conceptual precision in our measures of poverty and inequality more than we need larger masses of statistics. The trend toward more and more precision in measuring the wrong things needs to be reversed. A prime candidate for a better social indicator than unemployment or family income is a measure of the economic status of families that takes account of the main nonmoney items and of the leisure left to enjoy what they earn. We have suggested some ways of simplifying such indicators.

And then we need to understand better the dynamic processes by which the economic status of families change. Economists have fairly recently come to the realization that in the United States family income is not an exogenous variable in a consumption function, but something some families can change.[10] We need to know to what extent families really do control their own destinies, and the process by which their own attitudes and aspirations and behavior patterns interact with their economic status. Out of the findings of such a study, we should be able to develop a better national policy to eliminate dependency where we can but, in any case, to eliminate poverty.

[10] Dan Suits, "The Determinants of Consumer Expenditures, a Review of Present Knowledge," in *Impacts of Monetary Policy* (Prentice-Hall, 1963).

portunity that will attempt to understand the process by which families' economic status changes, with emphasis on changes in families near the poverty level.

The basic theoretical model behind the study posits that change in economic status of a family will cause changes in their attitudes, expectations, and beliefs about what is possible. Changes in these psychological variables will in turn cause changes in the family's economic behavior, thus affecting what the family does to increase its income or to use its income more efficiently. A family may try to increase its income by searching for new jobs or new sources of extra income or by working longer hours. It may use its income more efficiently by shopping carefully, planning ahead, avoiding or insuring risks, or restricting the number of children. These changes in behavior patterns are then expected to create further changes in the family's economic status.

In other words, we think there is a dynamic recursive system in which the family's behavior, its attitudes and aspirations, and its changes in economic status—all influence one another. But each of them can also be affected by outside events. A new job or a retraining opportunity may lead to an increase in family income, which may allow the family to save money, plan ahead better, pay off some debt, and then use their money more efficiently. And having been encouraged, the husband might seek a still better job or a second job.

On the other hand, there may be patterns of reaction that cause opportunities to be missed. A financial windfall may be wasted in celebration. There may even be cumulative downward spirals, each step reinforcing the last with difficulties leading to nonadaptive attitude changes, discouragement, apathy, short-time horizons, hostility, or aggression. The result can be a changed behavior pattern that exacerbates the difficulties and even also affects the next generation by altering the way people raise their families. What is often seen as a lack of imagination, initiative, or enterprise on the part of the poor may well be the result of long periods of frustration and the resulting hopelessness and apathy.

There will also be families which stay poor because of circumstances over which they have no control, because of situations in which nothing they could have done would have helped much. The study we are starting with the Office of Economic Opportunity should provide estimates of the number of such families. They are certainly deserving of regular financial help with a minimum of censure or interference.

While the basic model of the study is a dynamic one and while we shall be able over a period of years to see whether economic status, attitudes, and behavior patterns move together, we shall not be able always to specify the timing nor be able to infer the direction of causation in

earnings are associated with longer hours of work, taking account of the total work hours of the family, or rather of its remaining leisure, does not increase an overall estimate of inequality. Families that are better off actually tend to put in a large amount of work and to have slightly less leisure. The differences are small and not significant. The reason is probably that both high total family resources relative to need and ample leisure left to enjoy go along with small families, particularly for married couples with no children. Also, older retired people work less, and working wives produce the main increases in both family income and family work.

Some people will object to counting only the money returns from work and to counting leisure as worth something, on the grounds that some people enjoy their work and some do not enjoy their leisure. But all we really need to do is to assume that the last hour of leisure given up was worth something; namely, what the work pays plus any direct satisfaction the last hour of work gives. And it seems likely that for most people the last hour of work for money produces relatively little direct satisfaction. There may well be consumer surpluses for the intramarginal units of both work and leisure, of course. Our indifference curve index approach incorporates the surpluses too.

It seems too bad, at a time when more and more attention is being given to problems of poverty and inequality, that we rely upon an indicator of unemployment, recently tightened up one more notch, that is a small tip of a variable-sized iceberg, ignoring the vast fluctuations in extra work, and in the desires for more work than is available. And at the same time we continue to collect and talk about data on dollar family income that are half after-transfers (they include some transfers and not others) and half adequate (they include only regular dollar flows) and half-baked because they take no account of how many people depend on the income or on how long they work to get it.

The Dynamics of Improvement

• With an adequate measure of the well-offness of a family, changes can come in the family position if there are changes in: money income; non-money income from assets; nonmoney income from work; changes in family size or composition; changes in total work hours; extensive illness or unemployment that changes the meaning of leisure. At the border of unmeasurability there may also be changes in the extent to which people enjoy either their work or their leisure.

Any of these changes can come about exogenously, as business conditions change, or as illness, accident, or unemployment occur. Or they can derive from something the family does. We are starting a panel reinterview study in cooperation with the U.S. Office of Economic Op-

and leisure can be approximated by rectangular hyperbolas within the relevant range. Therefore an adequate index of family well-offness is the algebraic product of the two indexes. We can multiply them together without worrying that they are in different, and already complicated, units.

There has been a good deal of talk lately about social indicators. It seems to me that a prime candidate for such an indicator would be repeated measurements of such an index of well-offness based on representative national samples. Instead of merely counting the number of poor—defined as those with money income below the Orshansky level— we might rather provide a more meaningful measure. It would require asking of each family of a sample, its money income, its equity in service-producing assets like homes, its total hours of paid and unpaid work, its illness and unemployment experience over the past year, and its desires for more or less work.

If we then wanted a single trend figure of the extent of poverty in America, I should propose it be the proportion of the people in families where the family index of well-offness is less than a third of the national average of that index. We need to count people, not families, even though it is the family condition that defines poverty. By Orshansky definitions, for instance, 40 percent of the poor people in America are children. The fraction used for cut-off is arbitrary, but a lot less arbitrary than a fixed dollar boundary. Under such a definition we not only take care of leisure as well as goods and services, but we stand a chance of accounting for a total abolition of poverty. It is true that there will always be people below the average, but it need not be forever true that there are people below a third of the average.

We have already spelled out in some detail elsewhere what happens to estimates of inequality if one changes the unit of analysis or makes the measure of control over resources more comprehensive or makes adjustments for differences in needs.[9] Undoubling families by separating them into adult units uncovers some poverty hidden by doubling up and produces larger Gini coefficients. The inclusion of imputed and other nonmoney incomes improves the measured status of the aged and some other people with low money incomes and reduces inequality estimates. Taking account of family size and structure, say by dividing incomes by some estimate of the needs of a family of that type, produces lower measures of inequality, because many low-income families are small and many larger families are headed by a middle-aged person at his earning peak.

But interestingly enough and in spite of the fact that lower hourly

[9] James Morgan, "The Anatomy of Income Distribution," *Rev. of Econ. and Statis.*, Aug., 1962.

But perhaps the main problem with measures of economic status—a problem which applies to most of the work to date—is that these measures take no account of the work done to earn the income, or of the leisure left to enjoy it. Gary Becker has pointed out that consumption requires both time and money.[7] When we notice the vast differences in the amount of time people are devoting to earning money or to saving money by doing various productive but unpaid tasks, we realize that we must develop some measures of well-offness that take account of these differences.

Families vary in size, and a few preschool children can make a lot of work; so reported hours of housework vary from less than 240 to more than 4,500. The average bachelor reported 408 hours and the average wife 2,053. If we look at the total of hours of productive activity done by families, it varies from less than 1,000 per year to more than 10,000! We have estimated that including the money value of the unpaid work of American families—housework and work for charity as well as do-it-yourself projects—would increase the country's estimated gross national product by the more than one-third.[8]

A Proposed Measure

How can we develop a measure that combines such disparate things as money and nonmoney income, family size and need, work effort and leisure? Two manipulations will allow us to develop such a measure. First, while components measured in different units cannot be added or subtracted, they can be multiplied or divided.

Hence we can develop a reasonably good index of the adequacy of the family's command over goods and services by adding money and non-money incomes, deducting taxes, and dividing by some measure of the family need. Even if the measure of need is at the wrong level, it still adjusts for differences in family size and structure.

And we can develop an index of the amount of leisure enjoyed if we take twenty-four hours per person, deduct twelve hours a day for sleep and maintenance, deduct work time, deduct time of illness or unemployment, which is not enjoyable, and divide the remaining "enjoyed leisure" by the number of adults.

We now have two components of welfare: one an index of the adequacy of the family's command over resources and the other an index of the amount of enjoyable leisure left to the family. (We might want to adjust the latter further for those who say they want more or less work than was available, even if they were not unemployed or ill.)

We then proceed to propose that indifference curves between resources

[7] Gary Becker, "On the Economics of Time" (paper presented at Econometric Society Meeting, 1963).
[8] James Morgan, et al., Productive Americans, p. 5., 185ff.

money transfers. And they do not deduct such out-transfers as payments of income taxes, alimony, or charitable contributions. (2) They exclude nonmoney income from assets (imputed returns on investments in houses, cars, durables) and realized or unrealized capital gains on these or on financial assets. (3) And they exclude nonmoney income from unpaid work (housework, do-it-yourself projects, and contributing time by helping others or by working for charitable organizations). It is not difficult to assign dollar values to the nonmoney incomes from assets by selecting some rate of return on the net equity. In the case of the value of unpaid work there are several possibilities.

In our earlier study we simply asked people how much money they saved by their home production. In a more recent study, where we included housework and charitable work as well, we tried a number of dollar values per hour of time, including the individual's hourly earning rate.[6] We can argue that anyone free to choose between paid and unpaid work probably values his unpaid work at the same hourly rate as his paid work at the margin. So for measuring its value to the family, we might use such a measure. However, we might balk at including in the national output that part of the value of a man's church work or work in the garden that was a psychic return, valuable only to the doer.

There remain two other less important problems. First, the use of the family as a unit ignores the fact that some 17 percent of family units provide housing for adult relatives despite their overwhelming dislike of such doubling up. A great deal of private voluntary aid to the poor still takes the form of aid to relatives, and most of it is done by providing them with food and housing. In our earlier book, *Income and Welfare in the United States*, we arbitrarily separated these doubled-up families into their component nuclear units, called "adult units," and showed the impact of this on estimates of inequality. Indeed, discussions of the possible outlays involved in negative income taxes or other forms of guaranteed minimum incomes commonly ignore the fact that if one freely allowed undoubling, the total number of potential recipients would nearly double.

Second, we must allow for the emotional attachments the aged have to their own homes—attachments that produce expenditure disproportionality and inefficiencies in consumption. Ignoring the imputed rent clearly makes these people look worse off than they are. But including it at full value, as we did in our 1962 study, probably makes them look better off than they are. They cannot, after all, buy food or medical care with that imputed rent. Yet they would rather starve than move. The only solution to this impasse may be to evaluate people's incomes and their needs net of housing.

[6] James Morgan, *et al.*, *Productive Americans;* and Ismail Sirageldin, *Non-Market Components of National Income* (Univ. of Michigan, Ph. D. thesis, 1967).

Of course we professionals like to point to how hard we ourselves work at relatively high wages, and the backward sloping supply curve does reverse its direction at the very top. Indeed, we have found that the very highest income people are so driven to work, but by forces other than the monetary rewards, that they are deterred little if at all by the bite of income taxes on those rewards.[3] But although they are important they are a small part of the total population. Our studies of early retirement also indicate that some of the highest paid auto workers delay retirement, even though the main finding remains that it is those with the most seniority and the best retirement income who are retiring early under an early retirement plan.

Whatever we may conclude about the responsiveness of labor supply to economic incentives in the short run or the long, there are vast differences between people in their hours of work, particularly if we take the family as a unit. For family heads such things as extra jobs or overtime account for far more of the interpersonal differences in hours than do illness or unemployment. The large and growing number of working wives, predominantly younger wives without preschool children, accounts for still more of the large differences. And if we count the unpaid work around the house, still another source of variation, partially offsetting the last, appears. This brings us to point two: the need for improvements in measures of how well-off families are—improvements that take account of the work done and the leisure that remains.

The Measurement of Well-offness

Some years ago we used data from a national sample to derive measures of how well off families were; these measures took account of the unit, of nonmoney incomes, of income taxes, and of the varying needs of families.[4] In the recent attempts to measure poverty more precisely, reliance has been on money incomes relative to a set of standards based on family size—the famous Orshansky levels.[5] They can be summarized as calling for a base amount of $1,000 plus $500 per person, with some truncation for very large families and a reduction for farm families.

Because family income data include some transfers, they are not suitable for measures of the way a market system distributes earned incomes, and as measures of how well off families are, they are inadequate for a whole set of reasons: (1) They exclude nonmoney transfers (free food, clothes, housing, and subsidized medical care), and irregular

[3] Robin Barlow, Harvey Brazer, and James Morgan, *The Economic Behavior of the Affluent* (Brookings Institution, 1966).
[4] James Morgan, Martin David, Wilbur Cohen and Harvey Brazer, *Income and Welfare in the United States* (McGraw-Hill, 1962).
[5] Mollie Orshansky, "Counting the Poor: Another Look at the Poverty Profile," *Soc. Sec. Bul.* 28, (Jan, 1965) pp. 3–29.

average starts near 2,500 for those with the lowest hourly earnings, and decreases to 2,000 only when earnings get above $5.00 an hour. This theme of more work at lower wages is reinforced when we include the wife's work, the unpaid work of the family members, and the housework. And since we are concerned with the amount that people would like to work rather than the amount they do work, if we include the time ill or unemployed as part of potential supply, the effect of low wages in inducing a greater supply of labor is most dramatic.

How do we reconcile this with the trend for rising real wages to have little depressing influence on aggregate labor force participation or total work hours? We cannot argue simply that the income elasticity of the demand for goods and services is greater than the income elasticity of the demand for leisure, because that would be in conflict with the cross-section finding. It cannot so easily be explained as a problem of errors in variables and short-run change, as Friedman did with time series and cross-section discrepancies in the consumption function, because the short-run changes are in availability of jobs, not in wage rates. And indeed, when we count the total productive effort of the family, including the wife's work for money and everyone's unpaid productive efforts, the same backward sloping supply curve of effort appears in the cross-section data. It seems more sensible to argue that there are socially established standards of what an acceptable income level is, as the Department of Labor keeps telling us, and that people strive to get to them, by working harder if their wage rates are low. And these standards rise as the average income level rises.

Indeed, a similar kind of threshold or standard seems to exist in the case of retirement. We have a recent study on early retirement plans which seems to show that unless a person can count on a cash retirement income of $4,000 a year or more he is most unlikely to plan to retire early. Of course other constraints such as dependent children or unpaid mortgages remaining after age 60 restrain some others, but it seems likely that income standards exist, and that they will rise with increasing affluence in the future.

Another bit of evidence on income standards is that today a husband's income must be substantial if it is to discourage his wife from working. There is a substantial drop in the proportion of wives working only when the husband's income gets above $7,500. Where the wife is young, with little to keep her home, or alternatively where there are several children to feed so they need the money, the drop in labor force participation of wives comes only when the husband's income exceeds $10,000.[2] There are some married professional women who will work whatever their husband's income, but they are still a small minority of the wives.

THE SUPPLY OF EFFORT, THE MEASUREMENT OF WELL-BEING, AND THE DYNAMICS OF IMPROVEMENT

By JAMES N. MORGAN
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I want to do three things: attempt to reconcile some apparently contradictory findings about the supply of labor, propose some improvements that thereby need to be made in the way we measure a family's economic status, and describe a research project we have underway that may improve our understanding of why people stay poor, climb out of poverty, or fall into it.

At a time when concern with human capital makes its utilization an important issue and when studies of the labor force show its responsiveness to market conditions, our official definition of labor force and therefore unemployment have become increasingly narrow and stringent. The few percent who qualify as unemployed last week in the official statistics neither represent nor vary with the much larger numbers who were unemployed or ill during the last year, or who were looking for more work even though they had a full-time job. In the 1966 Survey of Consumer Finances, 16 percent of family heads reported a week or more lost from work by unemployment, and an equal number reported at least some days lost by illness.[1] But these are losses from the regular work, in a situation where many rely on overtime or extra work. So when we asked people whether they would like to work more hours a week, more than a third said yes, and among the uneducated and unskilled, more than half said that they would like more work. These findings refer to 1965, which was a good year. The results were similar for 1964.[2] Even allowing for some exaggeration, there is still a large gap between official estimates and the excess supply of labor. But the most interesting fact is that the less money people make per hour the more hours they report working, and the more extra work they want. This is true even if we eliminate the self-employed, the very young, and the very old. It becomes even more striking if we look at total hours of work done, paid and unpaid, by all family members. The less the head earns per hour, the more the whole family works. Half the family heads we interview claim to be working more than forty hours a week. If we eliminate from consideration the very young, the very old, and the self-employed, the average hours per year reported for 1964 were 2,200, when 2,000 would represent fifty weeks at forty hours a week. But the

[1] George Katona, *et al.*, *1966 Survey of Consumer Finances* (Ann Arbor, Survey Research Center, 1967), p. 134.
[2] James Morgan, Ismail Sirageldin, and Nancy Baerwaldt, *Productive Americans* (Ann Arbor, Inst. for Soc. Res., 1966), pp. 429, 431, 93, 94, 13, 43. See, also, George Katona, *et al.*, *1966 Survey of Consumer Finances*, p. 138.

ment or regulation of aggregate demand. The latter has proved unsuccessful, even on the part of the largest mature corporations, as indicated by the substantial fluctuations in automobile demand which year after year surprise the car industry. Much of the effort of mature corporations goes into trying to swim with the current and to find out in what direction the consumer is moving and what is acceptable to him, in order to adjust production schedules accordingly.[10] No doubt, the consumer's choice is restricted by what is offered to him, and the two-way flow of the learning process involves some "management." But restricted choice is not equivalent to absence of choice. For, although the environment sets limits to human discretion, the consumers' margin of action is yet sufficient to influence the economy greatly.

The difference between the two positions—control by the "technostructure" versus importance of consumer psychology—can best be illustrated by quoting Galbraith further. He draws the conclusion that ' it is to the nature and purposes of this management [by the mature corporation] . . . that the scholar must look if he is to have any adequate view of consumer behavior" [1, p. 214]. This paper was written in the belief that an adequate view of consumer behavior can be obtained only by considering principles of social learning and expectational dynamics, which indicate the influence of purposive adaptation to success and failure, as experienced in a personal as well as in a more general context.

The adaptive theory of consumer behavior represents a low-level theory. To construct a more general theory, comparative studies of consumer behavior in different societies may be utilized. Studies of consumer behavior in other affluent societies in which social learning may be slower or faster than in the United States, as well as in less developed countries, may provide new insights into the nature of the adaptive process.

[10] See [3], Chap. 26 on marketing research and Chap. 27 on the useless concept of consumer sovereignty. Galbraith acknowledges that "the control of demand . . . is not perfect" [1, p. 30] and writes that the revised sequence has not replaced the accepted sequence, but that both still "exist side by side," the one in the segment of the economy ruled by large corporations and the other "outside the industrial system" [1, p. 213]. Galbraith's failure to consider the psychology of the consumer is the more regrettable as he makes good use of entrepreneurial and group psychology in other parts of his book, in refuting theories about the power of impersonal market forces.

REFERENCES

1. John K. Galbraith, *The New Industrial State* (Houghton Mifflin, 1967).
2. George Katona, *Psychological Analysis of Economic Behavior* (McGraw-Hill, 1951).
3. ———, *The Mass Consumption Society* (McGraw-Hill, 1964).
4. George Katona and Eva Mueller, *Consumer Response to Income Increases* (Brookings Institution, 1968).

the transition from a need-economy to a wants- or aspirations-economy does not warrant such views.

We may recall the starting point of the author's studies of consumer behavior: Affluence makes for discretion of action by very many consumers. When not a few individuals, nor a thin upper class, but the majority of families have an income which suffices to cover more than subsistence needs, wants and aspirations are gratified which are discretionary and may be postponed or bunched. Then the frequency of genuine decisions increases and the study of consumer psychology becomes a necessary part of economic analysis.[8]

J. K. Galbraith begins his 1967 book, *The New Industrial State*, with a similar assumption: "High production and income . . . remove a very large part of the population from the compulsions and pressures of physical want" (p. 4). He continues, however, in a vein different from this author: "In consequence their economic behavior becomes in some measure malleable. . . . Along with prices and costs, consumer demand becomes subject to management" [1, pp. 4–5].[9] Thus instead of my proposition that "affluence makes for discretion in action," Galbraith concludes that "affluence opens the way for control over the consumer."

According to the traditional theory, Galbraith states, all power lies with the consumer: "the flow of instruction is in one direction—from the individual to the market to the producer" [1, p. 211]. This "accepted sequence" must give way to the "revised sequence" in which "the producing firm reaches forward to control its markets and on beyond to . . . shape the social attitudes of those, ostensibly, that it serves" [1, p. 212].

Yet interaction characterizes communication and learning. Although we learn from experience with others—from the teacher, from information received by word of mouth and the printed page, or radio and television, and also from advertisements—it is we who learn. Conditioning and stamping-in are limiting cases of learning which are most applicable to a situation in which we are not involved (when the choice does not matter) and least applicable to changing social attitudes. The unidirectional form of the revised sequence represents an exception as does the accepted sequence. Both sequences negate consumers' discretion and contradict psychological principles of learning (except under circumstances of servitude or compulsion).

Success or failure of large producers in influencing their specific product's share in the market is of lesser importance than the manage-

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[8] See [2] and [3]. Similar conclusions were also reached by foreign scholars. See Günter Schmölders, *Psychologie des Geldes* (Rowohlt, Hamburg, Germany, 1966), and Ernest Zahn in *Kölner Zeitschrift für Soziologie und Socialpsychologie* (1967), pp. 221 ff.

[9] See also: "The further a man is removed from physical need the more open he is to persuasion—or management—as to what he buys. This is, perhaps, the most important consequence for economics of increasing affluence" [1, p. 202].

Additional data were collected to shed light on the arousal of new wants after the gratification of other wants. The question of saturation may be studied by relating the various forms of personal financial trends to automobile turnover. Turnover rates were calculated from information on the times when members of a representative sample last bought a car and when they expected to buy their next car (within a year, within two or three years, etc.). It appeared that ++ trends are associated with fairly short turnover rates (with definite plans to buy a car within two years after the last car had been purchased) and other trends with long turnover rates or the response, "We will not buy a car during the next three years" (which response implies a long rate). The association between ++ trends and short turnover rates could not be explained by income and age alone.

The perception of progress or success stimulates fairly rapid "upgrading," while lack of progress results in failure to replace an old possession with a new one. This finding supplements earlier findings on the basis of which it was concluded that saturation depends primarily on lack of progress and pessimistic outlook rather than on the number and quality of goods possessed.[6] The older studies also provided justification for reversing the traditional assumption about consumption being a function of income. Income appeared to be a function of consumption needs and wants because the desire for more and better things induced many people to work harder, or to take up a second job, or for the wife to return to work.

Concluding Remarks

The price of affluence is not saturation and the lack of incentives. This conclusion contradicts the notion that saturation would eventually cause a collapse of the consumer economy. It has been frequently argued by social critics that prosperity must be its own gravedigger because after relatively short prosperous periods in which many people satisfy their wants, "people run out of things they can't do without."[7] Clearly,

[6] For instance, when asked to list things they would like to have or to spend money on, survey respondents mentioned many more desires in the early 1960's than in the early 1950's. It was not those who had bought many things in the recent past who expressed the fewest wants, but rather the old and the poor [3].

[7] It was also asserted that consumer demand had shifted from greatly needed and useful goods and services to the gratification of desires which were unimportant and were stimulated solely by advertising and the extension of credit. The views of Galbraith in *The Affluent Society*, of Toynbee and Packard were discussed by the author in Chapters 6, 7, and 8 of [3]. Galbraith used the expression "contrived wants," while Toynbee spoke of "bogus wants." Toynbee's statement may be repeated here: "An economy that depends for its survival on an artificial stimulation of material wants seems unlikely to survive for a long time." See also Thomas Balogh: "The resilience of the [American] economic system might be eventually sapped by the sheer satiety of the consumers" (*The Economics of Poverty*, New York, Macmillan, 1967, p. 161). This author has pointed out that all higher-order wants are learned and therefore do not originate with the individual alone; that changing and even influencing human beings is a difficult process which is usually incomplete; and that today's consumers, who are much better educated than their forefathers, are not puppets or pawns.

TABLE 2

RELATION OF INCOME TRENDS TO DISCRETIONARY BEHAVIOR, 1967

(Frequency with which the different income trend groups
engaged in various transactions in percent)

Transaction	B/W*			4PF†		
	++	One plus‡	No plus§	++	One plus‡	No plus§
	A. Unadjusted Frequencies					
Purchased durables in 1966⌗........	78	72	59	75	67	53
Incurred installment debt in 1966....	53	45	27	49	37	17
Intend to buy in 1967**						
Any durable.....................	64	51	33	57	42	28
Two or more durables.............	26	16	8	21	11	5
New automobiles.................	14	7	5	11	6	4
	B. Adjusted Frequencies††					
Purchased durables in 1966⌗.........	70	69	64	66	67	67
Incurred installment debt in 1966....	43	38	34	39	38	34
Intend to buy in 1967**						
Any durable.....................	55	48	38	48	43	42
Two or more durables.............	21	15	11	17	12	12
New automobiles.................	12	7	6	10	6	7
Percent of sample..................	19	29	40	39	24	18

Number of cases in entire sample: 3,165.

* Reports on being better or worse off than a year ago and on expecting to be better or worse off a year hence.

† Reports on income change over past four years and on expected income change in next four years.

‡ Cells +=, =+, +−, −+.

§ Cells ==, =−, −=, −−.

⌗ Percent of family units who bought a house for owner occupancy, or an automobile, or spent at least $100 on household appliances or on additions and repairs to houses. Buyers of two or more items are counted once.

** Percent of family units who in February, 1967, said that they will or probably will buy a house for owner occupancy, or a new or used automobile, a large household appliance, or that they will spend at least $100 on additions or repairs to homes during the next twelve months. New automobiles are included under durables, yet they are also shown separately.

†† Adjusted for the influence of age and income level.

tures should involve the exercise of greater discretion than planning to make one such expenditure; the influence of ++ trends is larger in the former than in the latter case.

The impact on behavior of feeling and expecting to be better off is greater than that of experiencing and expecting rising income. Furthermore (not shown in Table 2), expected income trends have a greater effect on buying plans than past trends. We conclude, therefore, that the subjective meaning of income changes does matter.

It is a central proposition of the adaptive theory of consumer behavior that success makes for the arousal of new wants and an improvement in the standard of living. The finding that cumulative improvement in the personal financial situation is linked with an increased rate of installment buying and of planning to purchase durable goods is in accord with that proposition.

TABLE 1

RELATION OF PAST INCOME CHANGES TO OPTIMISTIC INCOME EXPECTATIONS

Past Income Change (from previous year and from four years ago)	Income expected to be higher than now, both next year and four years from now	
	Unadjusted frequencies	Adjusted frequencies*
++......................	48%	41%
+=, =+................	22	25
+−, −+................	34	30
==......................	3	17
−=, =−, −−...........	16	23
Mean....................	31	31

Beta coefficient: .20
* In the process of adjustment the following five variables were taken into account:

Variable	Beta coefficient
Age	.29
Education	.13
Income level	.02
Self-employment	.04
Race	.01

NOTE: Similar relations were obtained when income expectations for the next year were related to income changes during the last year, or expectations for the next four years to changes during the past four years. The table indicates the relation of two expectations, considered together, to reports on two past income changes.

year prior to the determination of the expectations, as well as of plans to buy durables, are related in Table 2 to (a) cumulative gains (++), (b) gains that are not expected to continue (+= or +−) or expected gains that do not follow past gains (=+ or −+), and (c) the absence of past as well as expected gains. Since both the frequency of ++ trends and of durable purchases increases with family income and decreases with the age of the family head, the relations must be studied after income and age effects are eliminated.

It appears that the relatively high rate of past durable purchases on the part of respondents with ++ trends is due to income and age effects. But incurring new installment debt and especially buying plans are associated with ++ trends after the income and age effects are removed. There are indications that the failure to find an independent effect of the trends on past durable purchases is due to the inclusion of many relatively small or nondiscretionary transactions among the purchases of durables. The multivariate analysis shows that people with ++ trends, in spite of frequent past purchases, express buying intentions more frequently than people with other trends. The largest differences appear when plans to buy new cars are considered. This was expected because the purchase of new cars is more often discretionary than is the purchase of household appliances or of expenditures on home repairs and improvements. Similarly, plans to make two major expendi-

or stable income. Similarly, three moves are possible for a family with stable income (=), and three moves for a family with an income decrease (−).

The model applies not only to consecutive income changes, but also to successions of income changes and income expectations. Thereby a time perspective is considered which extends both backward and forward. The development in the first period stands for the experience of an income change, while the development in the second period is represented by income expectations that prevail at the end of the first period. Then we again distinguish nine moves; for instance, an income increase associated with the expectation of a further income increase (++), an income increase associated with the expectation of stable income (+=), an income increase associated with the expectation of an income decline (+−), etc.

Before considering past and expected trends together, we raise a question concerning the origin of expectations. The younger a person is, the more formal education he has, and the larger his income is, the more probable it is that he will entertain optimistic income expectations. In addition, past income change also influences the expectations, as shown in Table 1. We find that many more of those respondents who had income gains in the past were optimistic than of those who had other forms of income changes, even after the effects of the demographic factors were parceled out in multivariate studies. Past progress or success fosters optimistic income expectations.

Of greatest interest are the behavioral affects of "++ trends"; that is, income increases associated with optimistic income expectations. Several measures of such trends have been collected in recent surveys;[5] two of these measures will be discussed here: (1) personal financial situation at present better than a year ago and expected to be better next year; (2) income at present higher than four years ago and expected to be higher four years from now.

Subjective notions enter into both measures. This is true first of all of expectations which reflect people's aspirations. It is also true of the evaluation of the personal financial situation and even of reports about income changes over the past four years. In studying factors that influence consumer behavior, the impact of subjective factors is of special interest.

Survey data were collected on various aspects of the discretionary behavior of the same respondents for whom information on personal financial trends was available. The frequencies of all purchases of durable goods and of purchases on the installment plan during the

Beginning with early 1966 consumer sentiment deteriorated sharply. The decline indicated in advance the easing of automobile demand in the summer of 1966 and its sharp drop in the winter of 1966–67. Survey findings made it possible to attribute the decline in the index to experience with an expectation of price increases, awareness of rising interest rates, expectation of tax increases, and uncertainty and misgivings about the war in Vietnam.

The extent of the deterioration in consumer sentiment posed a threat of a substantial decline in consumers' discretionary expenditures and therefore of a recession in the consumer sector. Yet we skirted the recession, primarily because the incomes of very many consumers continued to advance and government expenditures increased greatly. Thus in 1966 the worsening in attitudes and expectations terminated earlier and at a higher level than the decline which ushered in the recession of 1958. Up to August, 1967, the improvement of attitudes was moderate rather than substantial.

These studies of the determinants of fluctuations in consumers' discretionary expenditures confirm that (a) both ability and willingness to buy are relevant, and (b) substantial changes in willingness to buy do occur among very many people at about the same time. Furthermore, these studies strongly support the notion that individuals see themselves as belonging to a larger whole and as sharing a common fate with it. Adaptation to business news occurs both when the news is favorable (as in 1965) and when it is unfavorable (as in 1966).

The studies have been extended to include the factors that determine changes in liquid saving (net addition to deposits with banks or savings and loan associations and to holdings of bonds and stocks). It was found that over short periods (three to six months) income increases and improvement in the financial situation had a prompt and above-average positive effect both on discretionary expenditures and on liquid saving [see 4]. On the other hand, everyday expenditures were adapted to income increases with a lag. The finding that the response of liquid saving to income increases has the same direction as the response of discretionary expenditures could be explained by the other finding that adding to liquid reserves represents a highly valued positive goal, just as improvement in the standard of living is a positive goal. On the whole, the American people were found to be thing-minded and security-minded at the same time.

The Impact of Personal Financial Progress

The model of income changes in two consecutive periods may make use of the Markov chain. A family that has experienced an income increase (+) may move along three paths. During the next period of time the family may have a further income increase, an income decrease,

trends, and the actual income changes or the actual economic developments. At certain times change in the ability to buy may be of paramount influence, while at other times willingness to buy may improve or deteriorate even when the changes in the environment are in the opposite direction.

In twenty years of studies intended to understand and predict the bunching of discretionary expenditures at certain times and their postponement at other times, the Survey Research Center has taken into consideration various kinds of attitudes and expectations. A summary measure of some of these attitudes was constructed in the form of an Index of Consumer Sentiment. The overall predictive value of changes in the index has been indicated by publishing regression equations for 1952–66 in which aggregate consumer expenditures on durable goods and the extension of installment debt were taken as the dependent variables. When income (representing ability to buy) and the index (representing willingness to buy)—both measured six to nine months earlier than the expenditures on durables and the incurrence of debt— were the independent variables in a time series regression, both were found to exert a significant influence and an R^2 of .91 was obtained.[4]

The performance of the index at turning points is noteworthy. The sharp increase in automobile sales in 1955 was foreshadowed by a rise in the index of 1954; the 1958 recession was indicated by a decline in the index as early as the first half of 1957 (when incomes did not decline); the prolonged upswing in durable expenditures from 1961 to 1966 was reflected by an upward trend in the index as well as in incomes (the index reached its highest levels in August and November, 1965); in 1966 the index declined sharply, again at a time when incomes did not decline.

The index, constructed in the same manner over several cycles, and in periods of upswing or downswing, may be viewed as reflecting attitudes which are of relevance for economic fluctuations in all postwar cycles. In addition, however, each business cycle is unique in many respects. Intervening variables indicating people's perception of unique developments and their attitudinal response to them have also been studied and proved useful in finding out why, at one time or another, consumer attitudes improved or deteriorated. Thus the high rate of spending in 1964–65 could be traced to confidence and optimism generated by such powerful stimuli as the tax cut of 1964, the frequent and sizable gains in wages or salaries in 1964–65, information about declining unemployment and, in 1965, by the notion that the war in Vietnam would contribute to the growth of the domestic economy.

[4] See the author's paper in the *American Statistician*, Apr., 1967. The index, its components, as well as other data collected in quarterly surveys, are published in annual monographs entitled *Survey of Consumer Finances* (Survey Research Center, Ann Arbor, Mich.).

the environment, and the effort required for decision making, genuine decisions are made under the impact of strong stimuli. Stimuli must be strong if they are to make people aware of a problem which calls for a new decision. In the absence of such stimuli, people continue to do what they have done before under similar circumstances; then habits determine behavior.

Social learning, that is, the acquisition of new opinions and attitudes by very many people, is slow and gradual, except under the influence of major events which call for a reorganization of the cognitive map and which occur rarely (for example, outbreak of war, revolution, runaway inflation). Group belonging influences the salience of information received as well as the learning process (social facilitation). Satisfaction and success serve as reinforcing factors and promote learning. Specific rewards, seen as attainable, constitute the strongest stimulus to effort.[2]

The principles of adaptive consumer behavior have been developed on the basis of empirical research. The work began by testing relatively simple hypotheses and continued by gradually revising and broadening the hypotheses. Two major parts of the empirical studies relating to discretionary expenditures will be summarized here in order to support the theory and illustrate the range of significant problems to which deductions from the theory are applicable.[3]

Understanding and Predicting Changes in the Demand for Durable Goods

It is postulated that consumers' discretionary expenditures are a function both of ability to buy and willingness to buy. Ability to buy is represented primarily by the income received in the period in which discretionary expenditures are made (usually a year) and also by the possessions of the consumer (the available financial assets, etc.) as well as by access to credit. Willingness to buy, the subjective component or the contribution of the "person," depends primarily on attitudes and expectations about personal finances and the economy as a whole.

Ability and willingness to buy interact. Each factor may change independently of the other. There is no one-to-one correlation between changes in the subjective evaluation of income trends or of economic

[2] The origin of the sociopsychological principles presented above has been discussed in [2]. The theory of levels of aspiration was first developed by Kurt Lewin. The part-whole relationship and the similar relation between the individual and the group derive from Gestalt psychology and may be expressed as follows: Item A, which is a part of whole X, may differ from the same item A which is a part of whole Y. A stimulus must therefore be viewed in the context of the whole to which it belongs. When something occurs a second time, it may not be the same as when it occurred the first time. Thus the same raise in salary may have a different meaning and may elicit a different response during a recession than during a prosperous period, or when it is viewed as a part of an upward trend or as a transitory gain.

[3] Regarding the relation of behavioral theory to empirical research, see the note by the author in *American Economic Review*, 1968. The adaptive theory is applicable to household decision making in general, for instance, to decisions about the acquisition of income and about saving, in addition to decisions about discretionary expenditures.

not cancel out; that is, when similar intervening variables arise under similar conditions and when similar intervening variables arise among very many people at approximately the same time.

2. Individuals (and families) function as parts of broader groups. The groups to which people feel they belong, with which they identify themselves and share a common fate, may be constituted by face-to-face groups (friends, neighbors, colleagues), by the firm or corporation for which they work, as well as by such broad groups as all those in similar occupations, or the community, or the entire country. The intervening variables tend to differ from group to group, but to be similar among members of the same group. Not only what happens to oneself, but also the perception of general economic trends, and of political trends as well, influences behavior and even the appraisal of one's financial prospects. Favorable or adverse news on general trends, even if it is not expected to alter the personal financial situation, has an affective connotation which may influence aspirations and promote or impede the gratification of wants.

3. Wants are not static. Levels of aspiration are not given once for all time. They are raised with success and lowered with failure. Success and failure are subjective concepts indicating the individual's perception of his accomplishments as well as disappointments. They are group-determined by being viewed in relation to the success or failure of others in one's group. Usually aspirations are reality-oriented and are slightly higher or slightly lower rather than substantially higher or lower than the level of accomplishment.

When people feel that they are making progress and when they are optimistic regarding their own and the economy's prospects, new wants arise. These wants become pressing after the gratification of other wants. Contrariwise, when a person is uncertain about the future or is disappointed because he is unable to accomplish what he wishes, the process of adaptation consists of scaling down his aspirations. Perceived inability to improve one's situation may result in a feeling of saturation with goods. The extreme case consists of resignation and the stifling of wants. But the feeling of saturation may be temporary, at least in the absence of repeated severe shocks. Similarly, adaptation through raising aspirations is often interrupted by plateaus and reverses.

4. Frequently neither success nor failure is experienced. In the absence of major personal financial stimuli or of significant information about general economic trends, habitual behavior prevails. Careful weighing of alternatives and choosing what appears most appropriate among the perceived alternatives is not an everyday occurrence. Because of inertia, the felt inability to cope with the manifold changes in

best alternative may be different today from what it was yesterday? Similarly, the permanent income hypothesis disregards the following question: Why is it that the estimation of the sum of expected income streams may be different today from what it was yesterday?

The proposition that the household's normal or permanent income is the primary determinant of consumer expenditures implies the rejection of the determining role of current income (usually defined as the annual income in the year in which spending and saving are measured). We concur with this aspect of the proposition because the time horizon of people is longer than a single year and extends backward as well as forward. Normal or permanent income may represent a meaningful and appropriate concept for the understanding of consumer behavior in certain cultures and at certain times. In a nonfluid society, in which the status of most people is determined by birth and class, people may have some idea of what is normal for them. The assumption that they disregard occasional deviations from the normal may then represent a useful starting point. But this approach is hardly applicable to a dynamic society. It is not applicable to present-day America, where far-reaching changes occur during the lifetime of many people and where generally people believe that it is in their power to induce changes in their environment.

When environmental changes due to outside influence as well as personal influence are common, purposiveness is best defined in terms of adaptation. The theoretical model of consumer behavior here proposed assumes purposive adaptation to changing circumstances, in contrast to the assumption that specific rules of behavior are set up and followed in a rigid manner over long periods of time. The model must consider change in behavior as well as the absence of change; that is, continuing with habitual behavior. The theory of adaptive consumer behavior is based on four principles.

Principles of Adaptive Behavior

1. Human response is a function both of changes in the environment (stimuli) and the "person": $R=f(E,P)$. Stimuli do not determine the response, but elicit it according to the motives and attitudes of the person responding.[1] Motives, attitudes, and expectations are intervening variables that mediate between stimuli and responses and are acquired through past experience. They influence the perception of changes in the environment and the response to them. They are relevant for the understanding of economic behavior when they are systematic and do

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[1] In the limiting case the impact of a stimulus may be so strong that the contribution of the person is negligible. Such reflex-like reactions are, however, hardly relevant for economic behavior.

BEHAVIORAL AND ECOLOGICAL ECONOMICS

CONSUMER BEHAVIOR: THEORY AND FINDINGS ON EXPECTATIONS AND ASPIRATIONS

By GEORGE KATONA
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Major propositions of what may be called an adaptive theory of consumer behavior are supported in this paper by empirical data collected in surveys conducted over several years. The theory makes use of socio-psychological principles of learning and of expectations; thus it is part of behavioral economics. Fluctuations in consumers' discretionary expenditures and saturation with durable goods or its absence will be discussed in order to demonstrate the explanatory power of the theory.

The principal features of the traditional theory of consumer behavior may be summarized, briefly and incompletely, by propositions about rationality and the dependence of expenditures on income: (1) the consumer chooses the best alternative among the conceivable courses of action open to him, and (2) the primary determinant of consumer expenditures, aside from tastes, is income (absolute or relative) or, according to more recent formulations, the normal or permanent income of the household.

In the proposed theory of consumer behavior the assumption is abandoned that consumer behavior is based on fully rational decision making. A genuine decision reached after careful weighing of alternative courses of action is an exception rather than the rule, in view of the great frequency of habitual behavior as well as the influence of long-established stereotypes. Yet consumer behavior is not capricious and is not incomprehensible, and in this sense is not conceived as irrational. This was found to be true in spite of the occasional occurrence of impulsive behavior and frequent deviations of individual behavior from the behavior of large groups of consumers with which the theory is concerned.

Furthermore, change in tastes will not necessarily be considered an exogenous variable that is not studied in economics. A dynamic theory that concentrates on the understanding of change in behavior must incorporate changes in tastes, preferences, and attitudes which result from the acquisition of similar information or experience by very many consumers. --

Instead of postulating that consumers maximize the value of the future stream of satisfactions or that they always do what they think is best at the time, the crucial question to be raised is: Why is it that the

search are quite relevant to the California battle of tuition fees, although Hirshleifer's analysis had to be based on some extreme, simplifying assumptions. To analyze the economics of information of people about other people is even harder. Game theorists have provided some building blocks. Ożga has worked on "imperfect markets through lack of knowledge" and Stigler on the information in the labor market. It is just one year ago that Leijonhufvud told this Association that Keynesian unemployment may be mostly due to lack of information. We know very little about the technology of such information; for example, about the optimal language. Indeed, many believe that the run on gold is dammed, not by verbal announcements in English or even in French, but by actually selling gold to all comers. And Radner has penetratingly pointed to the setup cost of information which makes for increasing returns to scale and makes it difficult to apply the classical theory of free markets, which reconciles optimality and stability.

All this discussion, mostly by young members of our Association, is very recent, very exciting, and, I believe, very important. The informational revolution is upon us, and the manipulation of symbols dominates our lives more and more. I do hope we shall soon understand how to harness and benefit from those trends in our culture.

single organizer is replaced by several. Their beliefs and utilities are not the same. They engage in a nonconstant sum game. The economist's problem is then shifted from the search for optimality to the search for stability: he tries to explain, as does the biologist or anthropologist, why certain arrangements, certain allocations of tasks and incentives (rewards) have a greater chance to survive over a given period than other arrangements, and under what conditions.

The criterion of survival, viability, stability guides the social scientist who describes, and tries to explain, the existing institutions. Yet not everything that is stable is desirable. Some wicked dictatorships have been quite stable. Along with the stability criterion, the economist uses a weak collective optimality criterion, a modest common denominator on which people might agree in spite of their divergent utilities and beliefs: an arrangement of tasks and incentives is optimal in this modest sense if there is no feasible arrangement that would be better or at least not worse for all members of the organization.

What, then, if we consider the whole society as an organization? How should incentives and tasks be allocated in a way that is stable or is collectively optimal, or, if possible, both? Further, some of us cannot help but smuggle in our own values, in particular a high valuation of liberty and equity. I suppose "public policy," "public good," in our tradition, mean somehow to reconcile the criteria of stability and of collective optimality with those of liberty and equity. Though the economic theorist prefers to hide behind the technical term "welfare economics," he means not just Secretary Gardner's Department of Health, Education and Welfare, but much more, the whole public policy. Nor is our special concern only education, even if taken in the broad sense of the communication of what my chart calls "data," to the whole or some parts of the public. For research, inquiry has been also our concern here. Public policy problems in the field of symbol manipulation are crudely exemplified by questions such as, "When, if at all, should the government subsidize or protect research and teaching and the dissemination of news?"

As far as I know, welfare economics of symbol manipulation is at its beginning. Special problems, such as the theory of patents and of public versus private broadcasting and, most importantly, of the economics of education, have been studied and the names of Silberston, Coase, Gary Becker come to mind.

On the more abstract level, a basic distinction exists between the information about external facts and the information conveyed to a member of society about the doings of others. A preliminary analysis of economic policy of information about external facts has been made by my colleague Hirshleifer. If correct, his conclusions on teaching and re-

of individual economies—historically and contemporaneously—may be reckoned in terms of the complexity of the business systems of the particular area in the particular era or at present. Industrialization is only one aspect of growth, and that advance may wither if not accompanied by evolution of ancillary and service business institutions operated by domestic citizens. Economic maturity is reached only when a diversified and multifunctional business network in the hands of native citizens has developed. English, German, Russian, Indian, and Argentinian economic evolution can be and should be interpreted from this point of view and measured by this yardstick. Achievement of such a network is to be more deeply viewed as manifestation of the entrepreneurial initiative and the breadth of self-stimulated market adequate for the subsequent endurance and expansion of the specific economy in question.

ENTREPRENEURSHIP IN ECONOMIC THEORY*

By WILLIAM J. BAUMOL
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The entrepreneur is at the same time one of the most intriguing and one of the most elusive characters in the cast that constitutes the subject of economic analysis. He has long been recognized as the apex of the hierarchy that determines the behavior of the firm and thereby bears a heavy responsibility for the vitality of the free enterprise society. In the writings of the classical economist his appearance was frequent, though he remained a shadowy entity without clearly defined form and function. Only Schumpeter and, to some degree, Professor Knight succeeded in infusing him with life and in assigning to him a specific area of activity to any extent commensurate with his acknowledged importance.

In more recent years, while the facts have apparently underscored the significance of his role, he has at the same time virtually disappeared from the theoretical literature. And, as we will see, while some recent theoretical writings seem at first glance to offer a convenient place for an analysis of his activities, closer inspection indicates that on this score matters have not really improved substantially.

This paper will undertake to examine three major matters. First, I will review briefly the grounds on which entrepreneurship should concern us. Second. I will seek to explain why economic theory has failed to develop an illuminating formal analysis of entrepreneurship and I shall conclude that it is unlikely to do so for the foreseeable future. Finally, I shall argue that theory can say a great deal that is highly relevant to the subject of entrepreneurship even if it fails to provide a rigorous analysis of the behavior of the entrepreneur or of the supply of entrepreneurship.

Before proceeding with the discussion I would like to make a distinction that is somewhat artificial but nevertheless important. It is necessary for us to differentiate between the entrepreneurial and the managerial functions. We may define the manager to be the individual who oversees the ongoing efficiency of continuing processes. It is his task to see that available processes and techniques are combined in proportions appropriate for current output levels and for the future outputs that are already in prospect. He sees to it that inputs are not wasted, that

schedules and contracts are met, he makes routine pricing and advertising outlay decisions, etc., etc. In sum, he takes charge of the activities and decisions encompassed in our traditional models.

The preceding description is not intended to denigrate the importance of managerial activity or to imply that it is without significant difficulties. Carl Kaysen has remarked that in practice most firms no doubt find themselves in a position well inside their production possibility loci and one of their most challenging tasks is to find ways of approaching those loci more closely; i.e., of increasing their efficiency even within the limits of known technology. This is presumably part of the job of the manager who is constantly on the lookout for means to save a little here and to squeeze a bit more there. But for many purposes the standard models would appear to provide an adequate description of the functions of the manager. Given an arrangement which calculation, experience, or judgment indicate to constitute a reasonable approximation to the current optimum, it is the manager's task to see that this arrangement is in fact instituted to a reasonable degree of approximation.

The entrepreneur (whether or not he in fact also doubles as a manager) has a different function. It is his job to locate new ideas and to put them into effect. He must lead, perhaps even inspire; he cannot allow things to get into a rut and for him today's practice is never good enough for tomorrow. In short, he is the Schumpeterian innovator and some more. He is the individual who exercises what in the business literature is called "leadership." And it is he who is virtually absent from the received theory of the firm.

I. *On the Significance of the Entrepreneur*

If we are interested in explaining what Haavelmo has described as the "really big dissimilarities in economic life," we must be prepared to concern ourselves with entrepreneurship. For the really big differences are most usually those that correspond to historical developments over long periods of time or to the comparative states of various economies, notably those of the developed and the underdeveloped areas.

It has long been recognized that the entrepreneurial function is a vital component in the process of economic growth. Recent empirical evidence and the lessons of experience both seem to confirm this view. For example, some empirical studies on the nature of the production function have concluded that capital accumulation and expansion of the labor force leave unexplained a very substantial proportion of the historical growth of the nation's output. Thus, in a well-known paper, Solow [6, p. 320] has suggested on the basis of American data for the period 1909–49 that "gross output per man-hour doubled over the in-

terval, with 87½ percent of the increase attributable to technical change and the remaining 12½ percent to increase in the use of capital."[1] But any such innovation, whether it is purely technological or it consists in a modification in the way in which an industry is organized, will re- quire entrepreneurial initiative in its introduction. Thus we are led to suspect that by ignoring the entrepreneur we are prevented from ac- counting fully for a very substantial proportion of our historic growth.

Those who have concerned themselves with development policy have apparently been driven to similar conclusions. If we seek to explain the success of those economies which have managed to grow significantly with those that have remained relatively stagnant, we find it difficult to do so without taking into consideration differences in the availability of entrepreneurial talent and in the motivational mechanism which drives them on. A substantial proportion of the energies of those who design plans to stimulate development has been devoted to the pro- vision of means whereby entrepreneurs can be trained and encouraged.

The entrepreneur is present in institutional and applied discussions of a number of other economic areas. For example, his absence is some- times cited as a significant source of the difficulties of a declining in- dustry, and a balance-of-payments crisis is sometimes discussed in similar terms. Thus both macro problems and micro problems offer a substantial place for him in their analysis. Whether or not he is assigned the starring role he would appear in practice to be no minor character.

II. *The Entrepreneur in Formal Models*

Contrast all this with the entrepreneur's place in the formal theory. Look for him in the index of some of the most noted of recent writings on value theory, in neoclassical[2] or activity analysis models of the firm. The references are scanty and more often they are totally absent. The theoretical firm is entrepreneurless—the Prince of Denmark has been expunged from the discussion of *Hamlet*.

It is not difficult to explain his absence. Consider the nature of the model of the firm. In its simplest form (and in this respect we shall see that the more complex and more sophisticated models are no better) the theoretical firm must choose among alternative values for a small number of rather well-defined variables: price, output, perhaps adver-

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[1] Solow's result and other similar conclusions have recently been challenged in an article by Jorgenson and Griliches [3]. However, their contention does not necessarily imply any denigra- tion of the role of the entrepreneur. They argue merely that entrepreneurship and innovation have achieved growth in outputs only with the aid of corresponding increases in input quanti- ties.

[2] There is one residual and rather curious role left to the entrepreneur in the neoclassical model. He is the indivisible and non-replicable input that accounts for the U-shaped cost curve of a firm whose production function is linear and homogeneous. How the mighty have fallen!

tising outlay. In making this choice management is taken to consider the costs and revenues associated with each candidate set of values, as described by the relevant functional relationships, equations, and inequalities. Explicitly or implicitly the firm is then taken to perform a mathematical calculation which yields optimal (i.e., profit maximizing) values for all of its decision variables and it is these values which the theory assumes to be chosen—which are taken to constitute the business decision. There matters rest, forever or until exogenous forces lead to an autonomous change in the environment. Until there is such a shift in one of the relationships that define the problem, the firm is taken to replicate precisely its previous decisions, day after day, year after year.

Obviously, the entrepreneur has been read out of the model. There is no room for enterprise or initiative. The management group becomes a passive calculator that reacts mechanically to changes imposed on it by fortuitous external developments over which it does not exert, and does not even attempt to exert, any influence. One hears of no clever ruses, ingenious schemes, brilliant innovations, of no charisma or of any of the other stuff of which outstanding entrepreneurship is made; one does not hear of them because there is no way in which they can fit into the model.[3]

It must be understood clearly that what I have been saying constitutes no criticism, not even an attempt to reprove mildly the neoclassical model of the firm. I think that model does what it was designed to do and does it well. Like any respectable analysis, one hopes that it will be modified, amended, and improved with time. But not because it cannot handle an issue for which it is irrelevant. The model is essentially an instrument of optimality analysis of well-defined problems, and it is precisely such (very real and important) problems which need no entrepreneur for their solution.

Some readers may suspect that I am subtly putting forward as more appropriate candidates for the job some alternative models of the firm with which I have to some degree been associated. But this is certainly not my intention, because it seems clear to me that these models are

[3] The problem was recognized long ago by Thorstein Veblen. One may recall the characteristic passage in which he described the economic man as "a lightning calculator of pleasures and pains, who oscillates like a homogeneous globule of desire of happiness under the impulse of stimuli that shift him about the area, but leave him intact. He has neither antecedent nor consequent. He is an isolated, definitive human datum, in stable equilibrium except for the buffets of impinging forces that displace him in one direction or another. Self-imposed in elemental space, he spins symmetrically about his own spiritual axis until the parallelogram of forces bears down upon him, whereupon he follows the line of the resultant. When the force of the impact is spent, he comes to rest, a self-contained globule of desire as before. . . . [he] is not a prime mover. He is not the seat of a process of living, except in the sense that he is subject to a series of permutations enforced upon him by circumstances external and alien to him" [7, pp. 73–74].

no better for the purpose than the most hidebound of conventional constructs. For example, consider what Oliver Williamson has described as the "managerial discretion models," in which the businessman is taken to maximize the number of persons he employs, or sales, or still another objective distinct from profits. True, this businessman has (somewhere outside the confines of the model) made a choice which was no mere matter of calculation. He has decided, in at least some sense, to assign priority to some goal other than profit. But having made this choice he becomes, no less than the profit maximizer, a calculating robot, a programmed mechanical component in the automatic system that constitutes the firm. He makes and enforces the maximizing decision and in this the choice of maximand makes no difference.

Nor can the "practical pertinence" of the decision variables make the difference in carving out a place for the entrepreneur. Maximization models have recently been developed in which, instead of prices and outputs, the decision variables are the firm's real investment program, or its financial mix (the proportion of equity and debt in its funding), or the attributes of a new product to be launched by the company. These decisions seem to smell more of the ingredients of entrepreneurship. But though the models may be powerful and serve their objective well, they take us not a whit further in the analysis of entrepreneurship, for their calculations are again mechanistic and automatic and call for no display of entrepreneurial initiative.

Finally, it must be understood that the timeless nature of these models has nothing to do with the problem. Professor Evans [2] long ago developed a model in which the firm considered the consequence of its decisions for the time path of prices and where the calculus of variations served as his instrument of analysis. In one of my own models the firm was taken to choose not a stationary, once-and-for-all output level, but selected instead an optimal growth rate. None of these alternatives helps matters. In all these models, automaton maximizers the businessmen are and automaton maximizers they remain.

And this shows us why our body of theory, as it has developed, offers us no promise of being able to deal effectively with a description and analysis of the entrepreneurial function. For maximization and minimization have constituted the foundation of our theory, and as a result of this very fact the theory is deprived of the ability to provide an analysis of entrepreneurship. The terminology of game theory has been extremely suggestive; the willingness of the behaviorists to break away from traditional formulations has been encouraging; but I see no real breakthroughs in this area even on the distant horizon. At most I hope for more brilliant observations and descriptive insights such as those provided by Schumpeter and more recently by Leibenstein, but I fore-

see for the immediate future no more formal, manipulatable engine of calculation and analysis.[4]

III. *On the Supply of Entrepreneurship*

There is yet another reason why a marriage between theory and policy is not easily arranged in this area. In its discussions of inputs our formal analysis deals, by and large, with the way in which these inputs are used, and tells us relatively little about where they come from. In our growth models, for example, the behavior of the labor supply exerts a critical influence on the economy's expansion path. But the deter- mination of the growth of the labor force itself is generally taken to be an exogenous matter. Similarly, in a neoclassical or a programming analysis of production one investigates how inputs should be used in the production process, but one assumes that their supply is somehow de- termined outside the system. Thus even if we were to develop a model which were successful in advancing the theory of entrepreneurship to the level of sophistication of our treatment of other inputs, we would have defined more effectively the entrepreneurial role, but we would have added relatively little to our understanding of the determinants of the level of output of entrepreneurship.

From the point of view of policy, however, the priorities would seem to be reversed. The first order of business in an economy which exhibits very little business drive is presumably to induce the appearance of increased supplies of entrepreneurial skills which would then be let loose upon the area's industry. The policy-maker thus is interested primarily in what determines the supply of entrepreneurship and in the means that can be used to expand it.

But there is reason to suppose that these issues are to a very consid- erable extent matters of social psychology, of social arrangements, of cultural developments and the like. And perhaps this is why many of the recent discussions of the theory of entrepreneurship have been con- tributed by the sociologists and the psychologists.[5] This may then be no

[4] My colleague, Professor Lewis, has adduced yet another reason why the current theory does not help us to understand the entrepreneur. He remarks in a note to me that "the entre- preneur is doing something new and is therefore to some extent a monopolist. . . . We have no good theory of entrepreneurship because we have no good theory of monopoly. Our theory that monopolists [act] to maximize profit is obviously absurd, given the low elasticity of demand of most monopolized products." I agree that this observation points to a most fundamental gap in the theory of the firm.

[5] For a remarkable study of entrepreneurship by a social psychologist, see McClelland [4]. While the book is not free of somewhat distracting jargon, and is naïve in spots, particularly in its literal interpretation of the role of the profit motive in economic analysis, it does offer a number of extremely interesting hypotheses and provides in their support quantities of psycho- logical test results relating to a great variety of cultures. In what is perhaps the most interest- ing part of his discussion from our point of view, the author claims to show that entrepreneurs are motivated by n-achievement (the need for achievement) and not by desire for money (pp. 233–37). In his tests, people with high levels of n-achievement do no better when offered larger

fortuitous development. The very nature of the more pressing issues relating to entrepreneurship may invite more directly the attention of the practitioners of disciplines other than theoretical economics.

IV. *A Place for Theory and Entrepreneurship*

Given these difficulties besetting any attempt to construct a relevant economic theory in the area, I can offer only one suggestion for a theoretical approach to entrepreneurship, but one which I think is not without promise. We may not be able to analyze in detail the supply of entrepreneurship, the entrepreneur's strategy choices, his attitudes to risk, or the sources of his ideas. But one can hope to examine fruitfully what can be done to encourage his activity. Here an analogy is illuminating. The Keynesian analysis really bypasses the issue of expectations which is surely at the heart of the investment decision and yet the model succeeds in coming to grips with some means that can stimulate investment. In the same way one can undertake to grapple, assisted by theoretical instruments, with the policies that encourage entrepreneurship.

This can be done by considering not the means which the entrepreneur employs or the process whereby he arrives at his decisions but by examining instead the determinants of the payoff to his activity.[6] In his operations he must bear risks, never mind just how he does this, but let the theory consider how the marginal costs of his risk bearing can be reduced. He employs the results of work in research and development; very well, let us investigate what means make it easier, economically, to undertake R and D. Theoretical analysis of the effects of alternative tax arrangements, for example, should shed some light on these matters. The role of the structure of interest rates is no doubt also pertinent and we do have a powerful body of literature which treats of

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amounts of money for success, whereas people with low *n*-achievement scores do much better when offered money. However, it should be noted that while a rise in absolute income levels does not seem to stimulate *n*-achievers, a rise in marginal returns does seem likely to spur them on, according to the author because it provides a clearer measure of accomplishment. (The economist would no doubt propose a different explanation.) He also claims to show that *n*-achievers choose smaller risks than the average man: they are not gamblers, but are calculators and planners. The entrepreneur is not essentially a man who chooses to bear risks—that is the speculator, a man with quite a different personality (pp. 210–25). Another interesting McClelland claim is that the *n*-achiever is not an individualist and does not depend for his success on private enterprise (pp. 292–300). He gets just as much satisfaction from the manipulation of a committee, or from working for a government, since his interest is in results rather than in these other considerations. This is perhaps the reason huge committee-run corporations can be successful.

[6] I believe the key element of Schumpeter's contribution to the theory of entrepreneurship is precisely of this variety. In its discussion of the functions of the entrepreneur, *The Theory of Economic Development* [5] offers us little more than a taxonomy. But enormous illumination is provided by Schumpeter's analysis of the process whereby the rewards of innovation are only gradually eroded by the competitive process and the corollary observation that some imperfection in the market mechanism is essential to permit some financial reward for innovation.

these matters. On all of these fronts analysis is well advanced and it is no heroic exercise to imagine rather complex and probing theoretical formulations capable of shedding light upon them.

It should be recognized, moreover, that such a theoretical analysis can be of enormous significance for policy. In a growth-conscious world I remain convinced that encouragement of the entrepreneur is the key to the stimulation of growth. The view that this must await the slow and undependable process of change in social and psychological climate is a counsel of despair for which there is little justification. Such a conclusion is analogous to an argument that all we can do to reduce spending in an inflationary period is to hope for a revival of the Prostestant ethic and the attendant acceptance by the general public of the virtues of thrift! Surely we have learned to do better than that, in effect by producing a movement along the relevant functional paths rather than undertaking the more heroic task involved in shifting the relationships. This is precisely why I have just advocated more careful study of the rewards of entrepreneurship. Without awaiting a change in the entrepreneurial drive exhibited in our society, we can try to learn how one can stimulate the volume and intensity of entrepreneurial activity, thus making the most of what is permitted by current mores and attitudes. If the theory succeeds in no more than showing us something about how that can be done,[7] it will have accomplished very much indeed.

[7] For a crude attempt at such an analysis, see the last chapter of [1].

REFERENCES

1. W. J. Baumol, *Business Behavior, Value and Growth* (revised ed., Harcourt, Brace and World, 1967).
2. G. C. Evans, "The Dynamics of Monopoly," *Amer. Math. Monthly*, Feb., 1924, pp. 77–83.
3. D. W. Jorgenson and Z. Griliches, "The Explanation of Productivity Change," *Rev. of Econ. Studies*, July, 1967, pp. 249–83.
4. D. C. McClelland, *The Achieving Society* (Princeton, 1961).
5. J. A. Schumpeter, *The Theory of Economic Development* (Cambridge, Mass., 1936).
6. R. M. Solow, "Technical Change and the Aggregate Production Function," *Rev. of Econ. and Statis.*, Aug., 1957, pp. 312–20.
7. T. B. Veblen, "Economics and Evolution," *The Place of Science in Modern Civilization* (New York, 1919).

ENTREPRENEURSHIP AND DEVELOPMENT*

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I

The received theory of competition gives the impression that there is no need for entrepreneurship. If all inputs are marketed and their prices are known, and if all outputs are marketed and their prices are known, and if there is a definite production function that relates inputs to outputs in a determinate way, then we can always predict the profit for any activity that transforms inputs into outputs. If net profits are positive, then this should serve as a signal for entry into this market. The problem of marshaling resources and turning them into outputs appears to be a trivial activity. From this point of view it is hard to see why there should ever be a deficiency of entrepreneurship. But there is frequently a lack of entrepreneurship. The answer is that the standard competitive model hides the vital function of the entrepreneur.[1]

My aim in what follows is twofold: to suggest a theory of the economy and of entrepreneurship in which entrepreneurship has a unique and critical role and to use this theory to indicate why entrepreneurship is a significant variable in the development process.

In a paper published in 1966 [9] I argued that there does not exist a one-to-one correspondence between sets of inputs and outputs.[2] There are three main reasons for this: contracts for labor are incomplete, the production function is not completely specified or known, and not all factors of production are marketed. I will argue that these are the basic postulates for an economy in which entrepreneurship has a distinct and critical role.

We may distinguish two broad types of entrepreneurial activity: at one pole there is routine entrepreneurship, which is really a type of management, and for the rest of the spectrum we have Schumpeterian or "new type" entrepreneurship. (We shall refer to the latter as N-

[1] This point is elaborated in detail in Professor Baumol's paper [3]. His quotation from Veblen is especially apt. Professor Hirschman makes similar points in [8a, pp. 2–5].

[2] See [9] for evidence of specific cases. Econometric evidence on production functions is hard to interpret. Production functions fitted for specific industries frequently have very low values for R^2. While this is consistent with the notion that there is no one-to-one correspondence between inputs and putputs, there are also many other reasons why the fits may be poor. See Marc Nerlove, "Recent Empirical Studies on the CES and Related Production Functions," in *The Theory and Empirical Analysis of Production* (N.B.E.R., 1967), p. 78.

entrepreneurship.) By routine entrepreneurship we mean the activities involved in coordinating and carrying on a well-established, going concern in which the parts of the production function in use (and likely alternatives to current use) are well known and which operates in well-established and clearly defined markets. By N-entrepreneurship we mean the activities necessary to create or carry on an enterprise where not all the markets are well established or clearly defined and/or in which the relevant parts of the production function are not completely known. In both cases the entrepreneur coordinates activities that involve different markets; he is an intermarket operator. But in the case of N-entrepreneurship not all of the markets exist or operate perfectly and the entrepreneur, if he is to be successful, must fill in for the market deficiencies. To my mind one of the main obstacles to our understanding of the entrepreneurial role lies in the conventional theory of the production function. This theory seems so reasonable at first blush that we are likely not to notice the subtle assumptions it makes. The basic culprits are the following assumptions: that the complete set of inputs are specified and known to all actual or potential firms in the industry, and that there is a fixed relation between inputs and outputs. The first assumption is implicit. To my knowledge, it is never stated explicitly, but I have not made an exhaustive search of the literature to check this. The second assumption is explicit, but it is rarely challenged.

In its usual conception the production function is considered to be clearly defined, fully specified, and completely known. Where and to whom in the firm this knowledge is supposed to be available is never stated. In fact, there are great gaps of knowledge about the production function. Points on the production function refer to well-defined inputs. To the extent that they are not completely defined in actuality, the entrepreneur must in some way make up the deficiency. Suppose that to produce a certain commodity, a certain type of machine has to be employed. If no one in the country produces such a machine and if imports are barred, only entrepreneurs who have access to information on how to construct the machine can enter the industry. The potential entrepreneur has to make up for a market deficiency. But that is not his only major function.

Important inputs not well marketed are types of management and market knowledge. Even managers of the more routine type may not be available in well-organized markets in many developing countries. Where available, their capacities may be very difficult to assess. One of the important capacities of management is the ability to obtain and use factors of production that are not well marketed. In some countries the capacity to obtain finance may depend on family connections rather than on the willingness to pay a certain interest rate. A successful

entrepreneur may, at times, have to have the capacity to operate well in the political arena connected with his economic activities.

The usual characteristics attributed to entrepreneurs involve gap-filling as one of their essential underlying qualities. For example, it may be thought desirable that entrepreneurs possess at least some of the capacities to: search and discover economic opportunities, evaluate economic opportunities, marshal the financial resources necessary for the enterprise, make time-binding arrangements, take ultimate responsibility for management, be the ultimate uncertainty and/or risk bearer,[3] provide and be responsible for the motivational system within the firm, search and discover new economic information, translate new information into new markets, techniques, and goods, and provide leadership for the work group. In a world of perfect markets, if such a world were possible, each of these characteristics would be marketed as a specific service. Thus, some firms might specialize in the discovery of economic opportunities and sell this information to others. A similar remark could be made of each of the capacities mentioned above. The reason that this is not the case is because some inputs are inherently unmarketable, and some are difficult to market and are frequently unmarketed. For example, we cannot have a perfect market in risk-taking since, among other reasons, there is a "moral risk" problem in profit insurance. (The entrepreneur can intentionally do poorly and cash in on the policy.) Similarly, if the motivational system is the sum of all the human elements and their relations to each other within the firm rather than something specifically provided from outside the firm, then this element cannot be marketed. One of our basic points is that the conditions for perfect markets and the nature of some commodities are inconsistent with each other.

It is important to stress that entrepreneurial activities do not arise only because of market structure imperfections. This view gives too shallow an interpretation of the entrepreneurial role.[4] First, some gaps in markets are inherent in all cases. Second, and what is perhaps less apparent, is that the entrepreneur has to employ some inputs that are somewhat vague in their nature (but nevertheless necessary for production), and whose output is indeterminate. The provision of leadership, motivation, and the availability of the entrepreneur to solve po-

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[3] Schumpeter [12, p. 137] is very firm on the point that the entrepreneur is not a risk bearer or uncertainty bearer: "The one who gives credit comes to grief if the undertaking fails." Furthermore, in countries with highly developed stock markets some entrepreneurs can shift the risk by selling shares.

[4] A narrow "imperfect market" interpretation of the entrepreneurial role gives the impression that markets are perfectable, say by the elimination of monopolistic influences, and that by doing so, the significant aspects of the entrepreneurial role can be eliminated thereby. This is not the view taken in this paper. The ideas of this paper are not brought out fully by thinking that the entrepreneurs' role depends only on market imperfections.

tential crisis situations, the capacity to carry ultimate responsibility for the organizational structure and the major time-binding (implicit or explicit) contractual arrangements are of this sort. Third, and most important, the entrepreneur has to possess what might be called, for want of a better term, an "input completing" capacity. If six inputs are needed to bring to fruition a firm that produces a marketable product, it does no good to be able to marshal easily five of them. The gap-filling and the "input-completing" capacities are the unique characteristics of the entrepreneur.

As we have defined the entrepreneur he is an individual or group of individuals with four major characteristics: he connects different markets, he is capable of making up for market deficiencies (gap-filling), he is an "input-completer," and he creates or expands time-binding, input-transforming entities (i.e., firms).

Entrepreneurship is frequently a scarce resource because entrepreneurs are gap-fillers and input-completers and these are scarce talents. Other things equal, the amount of gap-filling and input-completing required determines the degree of scarcity. Gap-filling is necessary because information about some inputs are unmarketable; and because private information about markets cannot always be proven and made public information. Of course, gap-filling will also be necessary where universalistic markets have not been developed, or where the inputs are, in principle, marketable but for some reason such markets have not arisen. For any given economic activity there is a minimum quantum of various inputs that must be marshaled. If less than this minimum variety is universalistically available, the entrepreneur has the job of stepping into the breech to fill the lack of marketable inputs; i.e., he must be an input-completer.

In my "X-efficiency" paper [9] I argued that neither individuals nor groups (say, firms) work as hard or as effectively or search for new information and techniques as diligently as they could, nor is effort maintained at a constant level. The nature and degree of directed human effort of a given individual is not invariable in the sense in which the characteristics of some physical inputs and their capacities may be said to be invariable. The degree of directed effort depends on a variety of factors that determine the internal motivational state of the firm and the external motivational state of the appropriate segment of the economy. Thus, under some circumstances the level of directed effort of the human inputs may be low and, as a consequence, some firms operate under a considerable degree of slack [5] [9]. Persistant slack implies the existence of entrepreneurial opportunities.

The motivational state is likely to be composed of the following elements: (1) The system of financial rewards for effort, some of which

may be directly related to the quantity of output but some of the rewards may not be clearly related to output. (2) There may also be a system of rewards and "punishments" related to aspects of behavior other than the productive ones. For example, promotion within a firm may be related to personality traits or kinship or personal ties unconnected to the direct pursuit of the aims of the firm. (3) Finally, there is an interpersonal mechanism of group approval and disapproval, as well as approval-disapproval relations between individuals in different relative hierarchical statuses that normally influence productive behavior. The sum of these relationships is essentially the motivational state of the system. It seems clear that the degree and nature of directed effort will depend on the motivational state. This is especially likely to be true for nonroutine aspects of directed effort such as those involved in the introduction of technological change.

There is a significant relation between the entrepreneur's perceptive capacity and the fact that firms operate under some degree of slack [9]. The existence of slack and the fact that not all inputs are marketed means that the market signals for profit opportunities are blurred. Since there is no one-to-one correspondence between inputs and outputs, a knowledge of output price and input prices can no longer yield the necessary signals. On the other hand, an error in perception can be partially counterbalanced by increased effort in marshaling resources and in operating the plant.

It is noteworthy that the traditional theory does not explain the existence of firms as time-binding entities. The theory presented here suggests that since the production function is incomplete, firms become valuable storehouses of detailed experience and knowledge. In part, this means that successful firms are entities that house successful motivational systems that can be retained only through a scheme of renewable contractual arrangements of different time durations. It is in this way that the firm captures some of the long-term benefits of previous gap-filling and input-completing conquests.

A way of looking at the essential elements is to visualize the economy as a net made up of nodes and pathways. The nodes represent industries or households that receive inputs (or consumer goods) along the pathway and send outputs (final goods and inputs for the other commodities) to other nodes. The perfect competition model would be represented by a net that is complete, that has pathways that are well marked and well defined, that has well-marked and well-defined nodes, and one in which each element (i.e., firm or household) of each node deals with every other node along the pathways on equal terms for the same commodity. In the realistic model we have in mind there are holes and tears in the net, obstructions (knots) along the pathways, and some nodes and path-

ways, where they exist, are poorly defined and poorly marked or entirely unmarked from the viewpoint of elements of other nodes. We may refer to this net as impeded, incomplete, and "dark" in contrast to the unimpeded and "well-lit" net that represents the competitive model. Of course, a portion of the real economy net may very loosely approximate the "unimpeded" net of the perfect competition model. Entrepreneurs working in the well-defined, non-hole, non-obstruction part of the net carry out routine entrepreneurial-managerial activities, while those that operate on the impeded, incomplete, and dark parts carry out N-entrepreneurial activities. Entrepreneurial activities will make some portions of the net less impeded through extending markets (i.e., creating new pathways) but may make others more so through the creation of monpolies, or the creation of other obstacles (e.g., high entry costs) where they previously did not exist. Inventions and the creation of new knowledge will to some extent extend the net to vague and incomplete areas, but other inventions may substitute relatively well-defined pathways and nodes for those which were ill-defined and obstruction-laden previously.

II

Although there is no universally accepted theory of development we can point to two important elements in the process: (1) Per capita income growth requires shifts from less productive to more productive techniques per worker, the creation or adopton of new commodities, new materials, new markets, new organizational forms, the creation of new skills, and the accumulation of new knowledge. (2) Part of the process is the interaction between the creation of economic capacity and the related creation of demand so that some rough balance between capacity growth and demand growth takes place. The entrepreneur as a gap-filler and input-completer is probably the prime mover of the capacity creation part of these elements of the growth process.[5]

We now know that development is not simply a process of physical and human capital accumulation in the usual sense. If that were all that were involved, then development would simply be a function of the willingness to save. Experience has shown that this is not the case. The work of Solow and others [1] [2] [13] have shown that growth cannot be explained by the contributions of the increase in standard inputs. The work of Chenery and Strout [4] emphasizes that the degree of capital absorption can be a significant constraint to growth in developing

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[5] The basic idea is that firms do not operate on their production possibilities frontier. In part, the internal motivational state of the firm determines the degree to which actual output is less than the production possibilities frontier output. Thus, costs per unit of output are not minimized. The size of the difference between actual costs and true minimum costs offers opportunities for those entrepreneurs who think they can produce at lower costs.

countries. The existence of and need for gap-filling and input-completing capacities could explain why standard inputs do not account for all outputs and why capital absorption should be a problem. Economic planning experience in many countries reveals that there is frequently a considerable divergence between plan targets and results. This divergence may be partly explained by the fact that enterpreneurship is not a normal input whose contribution can be readily determined, predicted, planned for, or controlled.

We now sketch briefly some of the basic strands of a theory from which the concept of the entrepreneur as a gap-filler and input-completer derives.

The demand side is determined by the following: (1) The maximal production possibilities set in the sense of maximum knowledge. By maximum knowledge we mean that the techniques are known somewhere in the world—knowledge that is conceivably obtainable although it may be at an exceptionally high cost. (2) We deduct from the large maximal possibilities set the subset of techniques in use and those techniques that contain the following basic characteristics: they are actually known in detail without anything more than routine search activities and the inputs required for production are marketed on a routine basis. (3) What is left is that portion of the maximal production possibilities set which forms the potential opportunities for gap-fillers. Now, gap-filling and input-completing activities are usually costly. Taking these costs into account and calculating the expected prices of marketed inputs and potential outputs, each element in the gap-filling opportunity set can be associated with a set of potential profits or losses (depending on who does the gap-filling). We reduce the gap-filling opportunity set to those possibilities that are associated with expected yields of positive net profits. This set is likely to be very much larger than what will actually be pursued by entrepreneurs. The gap-filling opportunity set is likely to be non-unique since the costs associated with gap-filling depend on the specific entrepreneur that attempts to take advantage of the opportunity. The sequence in which gap-fillers choose opportunities will determine the degree to which any one turns out to be profitable. In addition, the degree of effort put forth by different enterpreneurs and the same entrepreneur at different times will vary, depending on the personality, circumstances, and the motivating influences that exist at the time. Thus, the association between gap-filling opportunities and profitable opportunities is not likely to be a unique one-to-one correspondence.

The supply side is determined by the following: the set of individuals with gap-filling and input-completing capacities, the sociocultural and political constraints which influence the extent to which entrepreneurs take advantage of their capacities, and the degree to which potential

entrepreneurs respond to different motivational states, especially where nontraditional activities are involved. Clearly, the personality characteristics of entrepreneurs are important. Apart from gap-filling and input-completing capacities, the potential entrepreneurs' response to opportunities will depend on their preference for certain modes of behavior as opposed to others. Thus, the entrepreneurial personality theories developed by Hagen [6] and McClelland [10] which connect nurture to the creation of entrepreneurial drives are significant elements on the supply side. Last, but not least, the alternatives open to individuals are important, since we must take into account opportunity costs of entrepreneurial acts.

In such a theory growth would depend, in part, on the degree of routine entrepreneurship, the degree to which gaps and impediments in markets exist, and the quality, motivations, and opportunity costs of the potential gap-fillers and input-completers available.

It is not possible at this stage to develop a complete and detailed model of economic development and entrepreneurship. One reason for this is that we do not have, at present, a theory of obstructed, incomplete, and "relatively dark" economic systems. However, it may be useful to sketch briefly the broad outlines of what such a model might contain if further research proved successful.

The model, if it were successfully developed, should enable us to describe the the motivational state that arises from any given state of the impeded system and the reactions to the motivational state. That is, the model should show the links between the maximal opportunity set and those opportunities that are actually perceived and pursued by entrepreneurs. We now attempt to specify the links that are likely to be involved: (1) The input gaps are in part determined exogenously. (2) Given the input gaps, and the opportunity set, the interfirm motivational state should determine the degree to which firms expand in response to the pull of profit opportunities and the push of the fear of falling behind competitive firms. The interfirm motivational state itself is determined by the number of firms in the industry, the nature of the market structure, and the energy and aims of the entrepreneurs within these firms, which in turn determines the degree of competition between firms. The interfirm motivational state is unlikely to be sufficient to determine how any specific firm behaves. Among the intervening elements is the perceptive mechanism of the firm which determines the way in which firms receive, filter, and process market information and the degree to which firms become aware of changes of relative competitive status. (3) Thus, the intrafirm motivational state, whose constituents we have described above, determines how firms react to the activities of competitors, and to changes in the opportunities the firm faces. The intrafirm motivational state depends in part on the organizational

structure of the firm and in part on the rate of change of manpower (especially managerial personnel) within the firm. The basic notion here is that as new individuals enter the firm, the existing equilibrium between decision-makers and their reactions to each other and to external opportunities may change so that the intrafirm motivational state changes accordingly. Of course, this last depends also on the degree to which new management personnel are similar or different in their capabilities and attitudes from those that they replace. (4) Finally, the input-completing and gap-filling capacities of the potential entrepreneurial pool determines the response of members of this pool to changes in opportunities and motivational states. An important aspect of the abilities involved is both the perception of economic opportunities and the capacity to assess such opportunities. These are presumably determined in part by factors exogenous to the system such as those involved in nurture, informal training, experience, as well as formal education of individuals. In sum, the model should in some way enable us to specify the relations of the links mentioned to the nature of economic states so that we can determine entrepreneurial reactions to changes in the economic state.

It might be helpful to classify N-entrepreneurs into different categories and determine each category's responsiveness to a given motivational state. Probably a significant part of such a model would be the interaction of different types of entrepreneurs to each other's activities (i.e., imitation, linkages, followers on "cleared" pathways, knowledge spread, etc.). Each period the response of the N-entrepreneurs to the motivational state creates a new state of the system and changes the motivational states in subsequent periods. At the same time it changes the supply of N-entrepreneurs in subsequent periods since some of those that enter foreclose their availability on subsequent occasions. Thus, the impulses created by entrepreneurial acts lead to sequences of entrepreneurial activities and changing opportunities which influence the pattern and rate of growth.[6] In addition, basic secular factors would have to be taken into account, since each year some potential entrepreneurs retire and others enter, while, at the same time, inventions lead to changes in the technical frontier and add new elements to the impeded and incomplete part of the market net.

III

To be of interest a theory needs some conjectures to tell us how some basic elements in the theory behave. Hence, to add some interest to this

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[6] It would be interesting to see under what assumptions we could derive from such a model the growth promoting backward linkages suggested by Professor Hirschman [7] [8].

paper, I will hazard the following, all of which are on an "other things equal" basis: (1) The greater the rate of growth desired, the greater the quantum of gap-filling and input-completing capacities required. (2) The supply of active gap-fillers depends on opportunity costs. (3) The greater the assets of the group related to the gap-filler by kinship or friendship ties, the greater the gap-filling capacity of the entrepreneur involved. (4) Differential gap-filling and input-completing capacities are a critical element in explaining the differential rewards of entrepreneurs. (5) The routinization of gap-filling activities reduces the rewards of entrepreneurs.

There are a set of theories about entrepreneurship which revolve around the notions that in underdeveloped countries entrepreneurs prefer traditional industries, that their behavior is tradition-bound, and that they face overriding institutional obstacles. Yet, developing countries have periods of low growth and other periods of rapid growth. My conjecture in this connection is that in fact traditionalism is not the critical element but that the motivations present—e.g., the profit rates —are such that those with gap-filling capacities are willing and able to exert themselves under some motivational circumstances and reduce the degree of exertion under others. Thus, the ebb and flow of low and high growth rates can be explained without positing institutional rigidities that would appear to be almost impossible to overcome.

Two related elements that come to mind are the facts that entrepreneurs frequently come from groups which have fairly large extended families who are often engaged in trade and that they are disproportionately recruited from elements of the population that in some sense or other are looked upon as "outsiders." The extended family aspect can be explained by the fact that gap-filling capacities depend in part on kinship relations in which there is a much higher degree of trust and through which one can draw on more diverse capacities than exist on a universalistic basis. While there are many aspects to the outsider part of the phenomena, part of it, perhaps, can be explained by the fact that to the extent that outsiders are restricted from some economic opportunities, their opportunity costs as entrepreneurs are likely to be lower than other portions of the population, and hence they more readily engage in entrepreneurial activities compared to "insiders" whose opportunity costs are higher. However, not all outsiders become entrepreneurs since low opportunity costs can only be a facilitating and not a sufficient condition for entrepreneurship.

I realize that I run the risk of being charged, to use Professor Baumol's phrase, with offering nothing more than a taxonomy. I want to suggest that this is not the case—that the characteristics of the world described in this paper and the specified nature of the entrepreneurial role is such

that it does lead to potentially interesting conclusions for development problems.

Our basic assumptions are as follows: (1) Motivation internal to the firm is a basic input that is not marketed. (2) There always exists some degree of slack (or excess capacity) due to low X-efficiency. (3) To bring any enterprise into fruition requires the marshaling of a minimum quantum of inputs. (4) Some inputs are "nonexhaustible" in the usual sense; that is, they do not necessarily decrease with use. Indeed, in some cases the opposite may be the case. Knowledge and motivation are two inputs of this type.

Some possible conclusions derivable from our assumptions are as follows:

1. While entrepreneurship may be scarce because of a lack of input-completing capacities, some entrepreneurial characteristics may in fact be in surplus supply; that is, they are unused simply because of the lack of the input completing capacity. In addition, some may be unused because the motivational state does not bring forth an adequate entrepreneurial response. As a consequence, it is possible that in some cases, small changes in the motivational state or in the reduction of market impediments may turn entrepreneurial scarcity into an abundant supply.

2. Our analysis of entrepreneurship requires us to reconsider the literature on investment criteria. Since investment can alter the market impediments and hence alter the supply of entrepreneurship, we must consider such possible side effects in our investment criteria. Thus, a lower profit investment that releases entrepreneurial energies and capacities may be more fruitful in the long run than a higher profit investment, if profit is calculated apart from the side effects we have just mentioned.

3. Some types of input creation which would normally appear to be functional may in fact be dysfunctional when the side effects are taken into account. For example, some types of higher education provided to potential entrepreneurs may be dysfunctional in that it increases the opportunity costs of potential entrepreneurs and may as a consequence decrease the supply of entrepreneurship.[7]

4. The theory suggests that training can do something to increase the supply of entrepreneurship. Obviously, not all characteristics of entrepreneurs are trainable. However, since entrepreneurship requires a combination of capacities, some of which may be vital gaps in carrying out the input-completing aspect of the entrepreneurial role, training can eliminate some of these gaps. For example, it may be difficult to train people to spot economic opportunities, but it is possible to train them to

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[7] Somerset Maugham's story of the illiterate verger is an illustration of this possibility.

assess such opportunities once perceived. Similarly, certain managerial skills are trainable, but without them new firms might not survive because of their inability to overcome initial managerial difficulties.

For policy purposes, the theory suggests that development economists focus their attention when concerned with specific countries on studying the gaps, obstructions, and impediments in the market network of the economy in question and on the gap-filling and input-completing capacities and responsiveness to different motivational states of the potential entrepreneurs in the population.

REFERENCES

1. M. Abramovitz, "Resources and Output Trends in the United States Since 1870," *A.E.R.*, May, 1956.
2. O. Aukrust, "Investment and Economic Growth," *Prod. Meas. Rev.*, Feb., 1959.
3. W. Baumol, "The Entrepreneurship in Economic Theory," *A.E.R.*, May, 1968.
4. H. B. Chenery and A. M. Strout, "Foreign Assistance and Economic Development," *A.E.R.*, Sept., 1966, p. 686.
5. R. M. Cyert and J. G. March, *A Behaviorial Theory of the Firm* (Prentice-Hall, 1963).
6. E. E. Hagen, *On the Theory of Social Change* (Irwin, 1962).
7. Albert O. Hirschman, *The Strategy of Economic Development* (Harvard Univ. Press, 1951).
8. ———, *Development Projects Observed* (1967).
8a. ———, *Journeys Through Progress* (1963).
9. H. Leibenstein, "Allocative Efficiency vs. X-Efficiency," *A.E.R.*, June, 1966.
10. D. McClelland, *The Achieving Society* (Princeton, 1961).
11. G. F. Papanek, *Pakistan's Development* (Cambridge, 1967).
12. J. A. Schumpeter, *The Theory of Economic Development* (Harvard Univ. Press, 1951).
13. R. Solow, "Technical Change and the Aggregate Production Function," *Rev. of Econ. and Statis.*, Aug., 1957.

THE ENTREPRENEUR IN ECONOMIC HISTORY

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After recording the debate at the 1960 conference of the International Economic Association, the rapporteur reminded the conferees that "all their hypotheses [of economic growth] had to take account of the person who made so many of the decisions upon which growth depended—the entrepreneur" [48, pp. 475–76]. Thus it is somewhat paradoxical that the entrepreneur has been ignored in much of the recent literature of economic history. What makes this even more paradoxical is that historians of other specialties have increasingly seen business as playing a key role in general political and social change.

This paper undertakes to survey the development of historical approaches to an understanding of entrepreneurship, to assess briefly the results of scholarship carried on under the rubric of "entrepreneurial history," and to suggest the task remaining to be done.

I

Economic historians of the late nineteenth and early twentieth centuries devoted considerable attention to businessmen and firms. They pointed in their writings to the achievements of individual entrepreneurs, as well as the contributions of inventors to the development of new technology, in explaining economic expansion. But they did not attempt to define explicitly the role of the entrepreneur in economic change, although they appear to have implicitly assumed that he was an important agent. From another stream came more specific information about the activities of entrepreneurs: histories of companies and biographies of businessmen. While most of these were highly eulogistic, containing little of substance for the analyst, writers like Ida Tarbell and H. D. Lloyd began to delve into the study of business operations from another point of view, to stress the misdoings of entrepreneurs who had created large firms. Herbert Spencer provided for the late nineteenth and early twentieth century audience a widely accepted interpretation of the process of change in the business world—the survival of the fit. Most contemporary academics seem to have viewed the end result of this process as desirable in creating economic progress, but Veblen raised a strong dissenting voice.

In the first serious academic effort to study the historical role of the entrepreneur, dating from the late 1920's, its founder, N. S. B. Gras, initially conceived the subject in a broad manner—to place the business-

man specifically in the context of the complex economic structure of society. In other words, what came to be called "business history" was intended to be simply a branch of economic history [35, p. 17]. However, for a variety of reasons, the focus of research in the area narrowed to the study of management within individual firms. A number of valuable works emerged in the *Harvard Studies in Business History* in the 1930's and 1940's, ranging from business biographies of John Jacob Astor and Jay Cooke to histories of manufacturing companies, banks, a department store, and an advertising agency. Gras also undertook to organize a large-scale study of Standard Oil, an ambitious project that was to consume the labors of several scholars and a corps of researchers for well over a decade.

But this attempt to place the entrepreneur more concretely within the context of economic history had apparently reached an intellectual dead end by the 1940's. By restricting the focus of research to business policy making and management within the individual firm, it had apparently isolated the subject from the mainstream of economic history. This does not mean that business historians were unaware of a major goal of their study. As Henrietta Larson, one of the most capable practioners of the field, pointed out in 1950: "In time, many business historians, working in fruitful cooperation with historians and other workers in related fields, may build an understanding . . . of economic growth." But she put her finger on one facet of the problem: "One of the weaknesses of business history—as indeed of business—is the fact that it does not have the support of an established system of theory. . . . It is a grave question whether business history can hold its own without the support of a theory that comes close to the realities of business" [36, pp. 128–29, 135].

A second concerted effort to place the entrepreneur in economic history came with the establishment of the Research Center in Entrepreneurial History at Harvard in 1948.[1] Under the direction of A. H. Cole, who had already outlined "An Approach to the Study of Entrepreneurship" in his 1946 presidential address to the Economic History Association [23] the Center would channel the efforts of historians, economists, sociologists, and other scholars interested in the entrepreneur. The new approach to the study of the entrepreneur was to be just the opposite to that of the older business history. While the Grasians knew precisely what they were doing—studying internal management of individual American firms—the Center was to practice no unity of subject or method. In essence, the field of entrepreneurial history would have almost unlimited boundaries.

[1] Accounts of the history of the Research Center in Entrepreneurial History, as seen by participants, have been written by Aitken [1], Cole [21], Crandall [24], and Sawyer [49].

The first endeavors to make tentative analyses of the area to be studied show the diversity of approaches. Much speculation centered on Schumpeter's concept of the entrepreneur as the innovator, the one responsible for "the doing of new things or the doing of things that are already being done in a new way" [50, p. 151]. Among the many attempts to define more precisely this concept, Redlich, for one, distinguished between primary and derivative innovations, as well as subjective and objective ones [44]. On the other hand, Cole urged that entrepreneurship be viewed as a function which he described as "the integrated sequence of actions" made in individual business units, "such actions being modified in greater or less degree by contemporary economic and social forces." As a means of generalization, he advanced the concept of three stages of entrepreneurship, designated as empirical, rational, and cognitive [22] [46].

Jenks and Cochran suggested a completely different approach. Assuming that entrepreneurial history tried to account not "for the performance of particular individuals" but rather "for the performance of similar functions by a considerable number of individuals," Jenks argued that sociological concepts of role and sanction would provide analytical tools leading to a meaningful understanding of what an entrepreneur did and why he did it [31] [46]. Cochran explored the relationships between social role and social sanctions, the latter reflecting the basic assumptions of a society, seeing this interplay as the key to interpreting changes in business behavior [46].

These ideas represent only some of the diverse approaches to entrepreneurial history in its initial years. Participants in meetings held at the Center in 1948–49, reported in *Change and the Entrepreneur*, discussed a wide variety of subjects, with a major effort to elaborate typologies of entrepreneurship. The early issues of *Explorations in Entrepreneurial History*, undertaken initially as a kind of "house organ," emphasized the varying theoretical approaches to the study of the businessman or other agent bearing the entrepreneurial function, however the latter might be defined.   •

The concepts that had been advanced served as springboards to research in many specific areas. By 1952, the practioners of entrepreneurial history were ready, in *Men in Business*, to set forth the concrete results of their investigations. The theme of the volume, as set forth by William Miller in the introduction, was a broad one: "Common to all of these essays is the assumption that in the making of the western world in modern times business has been a prodigious force" [37, p. 1]. The subjects ranged among diverse topics, from an analysis of relationships between the entrepreneur and the social order in France to studies of innovations in electric traction and life insurance, as well as an investi-

gation of social origins and careers of business leaders in nineteenth— and twentieth—century America. Miller drew attention to the contribution of "general theories of personality, like general theories of economic activity and economic development" to the essays [37, p. 5].

Similarly, a brief catalogue of books whose publication was sponsored by the Center reveals a broad range of approaches and a wide diversity of subject matter: the process of innovation in the electrical industry in the late nineteenth century by Passer [40], use of social role theory to analyze patterns of thought of railroad leaders by Cochran [15], an account of the promotion and construction of the Welland Canal by Aitken [3], and the development of business management in the nineteenth and twentieth centuries by Aitken [2], Chandler [9], and Nadworny [39]. Works by Bailyn on seventeenth-century merchants [6] and by Diamond on the reputation of the businessman [26] are oriented toward consideration of business as a social institution. On underdeveloped areas, the role of international financiers in nineteenth-century Egypt is analyzed by Landes [33], while the activity of the Brazilian industrialist is explored by Stein [51].

Other threads in the pursuit of the entrepreneur can be followed in the issues of *Explorations*. Redlich stimulated an interest in the European aristocrat as an entrepreneur, a subject to which an entire issue of this journal was devoted in 1953 [52]; and he proposed an examination of the role of the European military enterpriser, a work he has recently carried to completion [45] [42]. At the opposite end of the social spectrum from the aristocrat was the serf, whose entrepreneurial behavior was studied by Rosovsky [47]. Pelzel investigated a segment of small business in Japan [41]; Belshaw analyzed the Melanesian entrepreneur [8]; Williams surveyed the role of Chinese businessmen in Indonesia [53]; and Muri traced the beginnings of state enterprise in New Zealand [38].

II

What conclusions can be derived from these diverse studies of the entrepreneur in such a wide variety of historical situations? First, the books sponsored or stimulated by the Center represent important contributions to historical scholarship; several have already established themselves among the "classics" of economic history. This point should be emphasized, since one of the original purposes of the Center was to encourage the channeling of talent into the field of economic history.

More specifically, investigation of entrepreneurship (largely in business firms) as it was carried out in many historical situations,approached in diverse ways, led to a broadening of the concept of the entrepreneur beyond the classic model set forth by Schumpeter. Various conceptualizations were set forth as tools of analysis, but entrepreneurial

history adopted a pragmatic approach of considering as its field of study the businessman or other agent in society as a factor in economic change. As Sawyer put it, attention spread from the few to the many, from the spectacular individual entrepreneurs making major innovations to "an army of lesser innovators and imitators, and on the ways in which this larger number perceive and react to shifting objective possibilities" [49, p. 440].

This does not imply the existence of agreement on precise concepts. For example, Chandler and Redlich set forth in 1961 a conceptual model of business administration, envisioning three levels of administration in the large corporation; they designated as "entrepreneurial" in function only the top level, making long-range strategic plans and allocating the means of production through budget controls. But it is instructive to note that the leading historians invited to comment widely disagreed among themselves on specific points of criticism. One critic suggested that the problem be settled by dropping the term "entrepreneur" entirely [13].

Precise definitions and conceptualizations are, of course, useful as analytical tools for specific tasks. Yet it seems correct to view entrepreneurship in a broad way as embracing, in Hirschman's terms, both the "creative" and "cooperative" elements [28, pp. 16–18], on the assumption, as Aitken has put it, that "the way behavior was organized was functionally related to the sort of economic performance that resulted" [4, p. 7]. That organization is related to innovation is well illustrated by Alexander's remark that in underdeveloped countries "entrepreneurial talent may be scarce, entrepreneurs with sufficient capital are scarcer, but even scarcer are entrepreneurs who must also possess managerial skills" [5, p. 139]. To put this a different way, the not very tidy assumption can be made that entrepreneurship comprises "a more or less continuous set of functions running from the purely innovative toward the purely routine," performed within business firms or other agencies "at many levels of initiative and responsibility, . . . wherever significant decisions involving change are made affecting the combination and commitment of resources under conditions of uncertainty" [49, p. 439].

Furthermore, entrepreneurial history has stressed the relationship between economic change and the sociocultural setting within which that change takes place. From research focused on this problem, we now have a clearer understanding of the way in which social and cultural elements, through their influence on the character of entrepreneurship, have to be considered, along with economic forces, as determinants of the course of economic change. For examples, Cochran, making use of an analytical framework resting on sociological and anthropological

theory, has emphasized the relationship between cultural themes and economic performance in studies of Latin-American entrepreneurship [14] [19] [16], as well as in his recent model of "The Entrepreneur in Economic Change" [17]. Also, Landes has emphasized the play between economic forces and institutional factors affecting the performance of enterprise and thereby contributing to the different rates and patterns of growth among nations in nineteenth-century Europe [34]. Various other scholars, assuming the importance of the quality and quantity of entrepreneurship for economic growth, have concentrated on seeking the sources of this phenomenon in the social structures of underdeveloped countries.

III

Despite the vast amount of information generated about entrepreneurs and entrepreneurship and the development of many new points of view, entrepreneurial history has done relatively little thus far to provide a comprehensive synthesis of entrepreneurial change and its relation to economic change, or to use the phrases advanced by Redlich, a "history of business" specifying the role of "business in history" [43, pp. 68–70]. Cole provided some suggestions of elements to be incorporated into such a synthesis in his summary of the work of the Center in 1959, and has further elaborated on these ideas in more recent articles. He has advanced the concept of a business system, the development over time of a diversified and multifunctional network stimulated by entrepreneurial initiative [20] [21] [23]. Chandler has developed a historical account of changing American management structures and the influences contributing to their development [10] [11] [12]; Hughes has attempted to place the entrepreneur in the mainstream of economic development by focusing on eight "tycoons" [29]; and Cochran has reviewed the role of business in American society [18].

Wohl perceived as long ago as 1954 the nature of the task of entrepreneurial history: "American economic growth was accomplished, in the main, through the decentralized decision-making of a multitude of entrepreneurs. . . . The chief problem . . . is to discover some way in which the diverse and separate activities of a multitude of independent firms can be woven together" to explain the development of the nation [54, p. 131].

Using economic theory as a guide, one explanation can be found in the operation of the market mechanism. Thus, the "multitude of independent firms" can be assumed to respond in an almost automatic way to the opportunities generated in the market. In other words, opportunities produce the entrepreneur, the demand for whose services depends on such factors as the size of the already existing market.

The model is consistent with received economic theory. But, as Hughes has recently pointed out, "not all knowledge generated in economic history needs a springboard in general principles or 'theory.' " Advances in science are made through "measurement and study of phenomena . . . as well as theoretical speculations." He reminds us that "phenomena occur without reference to theoretical speculation." Thus, it should not be surprising to any investigator to find facts which do not fit into a logical body of theory. The economic historian, like any other historian seeking the truth, must pay attention to the facts, some of which are "external" to a given theory [30, pp. 76, 82, 93–94]. This means, in the context of our discussion, entrepreneurial behavior as a factor in economic change.

This does not mean that the historian should ignore theory in his investigation. At the very least, he should follow the advice offered recently by Professor Dales: to check the price ratios between wood and coal in America and Europe before concluding that a wood-burning railroad entrepreneur was technologically backward to his European counterpart using coal [25, pp. 35–36]. But of course he may find that his entrepreneur was not a very good economist and thus have to seek the explanation elsewhere than in economic factors. Certainly, theory is useful in helping to formulate hypotheses to study entrepreneurial behavior. Galambos has made some fruitful suggestions on the application of the theory of the growth of the firm to the study of business history [27]. Particularly instructive is the way in which Johnson and Supple have skillfully employed theoretical concepts of the investment process to sharpen their own analytical tools to study the role of Boston investors in western railroads [32].

But, as Basmann has urged in a recent article on the relation between history and theory, the competent historian should not be "so content with the existing degree of empirical confirmation of proffered 'economic laws' that he will hesitate to offer generalizations and hypotheses of his own making if the latter seem better to account for the facts at his disposal." Historians often frame explanations, based on facts produced by historical inference, "that might contradict some proffered 'economic laws.'" But, Basmann continues, "the only really sound argument against a piece of research in economic history is . . . that at some point or other its assumptions or conclusions are at variance with publicly available independently warranted statements of fact" [7, pp. 177,179].

Just as the economist has not developed a generally accepted overarching theory of long-term economic growth, business history has not yet created a satisfactory general hypothesis of the role of entrepreneurship. Yet, as suggested in this paper, some promising approaches have been pioneered, and some promising, though limited, generaliza-

tions advanced. Possibly, we stand on the brink of some great theoretical breakthrough; one hopes for but despairs of such a miracle. But in the meantime economists and historians alike have no alternative but to bend their energies to greater familiarity and better understanding of the facts while exploring promising but limited generalizations.

REFERENCES

1. Hugh G. J. Aitken, (ed.), *Explorations in Enterprise* (Cambridge, 1965).
2. ———, *Taylorism at the Watertown Arsenal: Scientific Management in Action, 1908–1915* (Cambridge, 1960).
3. ———, *The Welland Canal Company: A Study in Canadian Enterprise* (Cambridge, 1954).
4. ———, "The Future of Entrepreneurial Research," *Explorations in Entrepreneurial History*, Fall, 1963, pp. 3–9.
5. Alec P. Alexander, "The Supply of Industrial Entrepreneurship," *E.E.H.*, Winter, 1967, pp. 136–149.
6. Bernard Bailyn, *The New England Merchants in the Seventeenth Century* (Cambridge, 1955).
7. R. L. Basmann, "The Role of the Economic Historian in Predictive Testing of Proffered 'Economic Laws,'" *E.E.H.*, Spring/Summer, 1965, pp. 159–86.
8. Cyril S. Belshaw, "The Cultural Milieu of the Entrepreneur: A Critical Essay," *E.E.H.*, Feb., 1955, pp. 146–63.
9. Alfred D. Chandler, Jr., *Henry Varnum Poor: Business Editor, Analyst, and Reformer* (Cambridge, 1956).
10. ———, *Strategy and Structure: Chapters in the History of the Industrial Enterprise* (Cambridge, 1962).
11. ———, "The Beginnings of 'Big Business' in American Industry," *Bus. Hist. Rev.*, Spring, 1959, pp. 1–31.
12. ———, (with assistance of Stephen Salsbury), "Le Role de la firme dans l'économie américaine," *Economie Appliquée*, 1964, pp. 303–52.
13. ———, and Fritz Redlich, "Recent Developments in American Business Administration and their Conceptualization," *B.H.R.*, Spring, 1961, pp. 1–27, and "Comments," Autumn, 1961, pp. 429–44.
14. Thomas C. Cochran, *The Puerto Rican Businessman: A Study in Cultural Change* (Philadelphia, 1959).
15. ———, *Railroad Leaders, 1845–1890: The Business Mind in Action* (Cambridge, 1953).
16. ———, "Cultural Factors in Economic Growth," *J. of Econ. Hist.*, Dec., 1960, pp. 515–30.
17. ———, "The Entrepreneur in Economic Change," *E.E.H.*, Fall, 1965 pp. 25–38.
18. ———, "The History of a Business Society," *J. of Amer. Hist.*, June, 1967, pp. 5–18.
19. Thomas C. Cochran and R. E. Reina, *Entrepreneurship in Argentine Culture* (Philadelphia, 1962).
20. Arthur H. Cole, *Business Enterprise in Its Social Setting* (Cambridge, 1959).
21. ———, "Aggregative Business History," *B.H.R.*, Autumn, 1965, pp. 287–300.
22. ———, "An Approach to the Study of Entrepreneurship: A Tribute to Edwin F. Gay," *J.E.H.*, Sup. VI, 1946, pp. 1–15.
23. ———, "What is Business History?" *B.H.R.*, Spring, 1962, pp. 98–106.
24. Ruth Crandall, *The Research Center in Entrepreneurial History at Harvard University, 1948–1958: A Historical Sketch* (Cambridge, 1960).
25. John H. Dales, "Business History and Economic Theory," *Proceedings of the Fourteenth Annual Meeting of the Business History Conference* (London, Ont., 1967).
26. Sigmund Diamond, *The Reputation of the American Businessman* (Cambridge, 1955).
27. Louis Galambos, "Business History and the Theory of the Growth of the Firm," *E.E.H.*, Fall, 1966, pp. 3–16.
28. Albert O. Hirschman, *The Strategy of Economic Development* (New Haven, 1958).
29. J. R. T. Hughes, *The Vital Few: American Economic Progress and Its Protagonists* (N. Y., 1966).
30. ———, "Fact and Theory in Economic History," *E.E.H.*, Winter, 1966, pp. 75–100.
31. Leland H. Jenks, "Approaches to Entrepreneurial Personality," *E.E.H.*, 1950, pp. 91–99.
32. Arthur M. Johnson and Barry E. Supple, *Boston Capitalists and Western Railroads: A Study in Nineteenth-Century Railroad Investment Process* (Cambridge, 1967).
33. David S. Landes, *Bankers and Pashas: International Finance and Economic Imperialism in Egypt* (London, 1958).
34. ———, "Technological Change and Development in Western Europe, 1750–1914," in *The*

Cambridge Economic History of Europe, Vol. VI; *The Industrial Revolutions and After*, ed. H. J. Habakkuk and M. Postan (Cambridge, England, 1965).
35. Henrietta M. Larson, *Guide to Business History* (Cambridge, 1948).
36. ———, "Problems and Challenges in Business History Research with Special Reference to the History of Business Administration and Operation," *Bul. of the Bus. Hist. Soc.*, Sept., 1950, pp. 120-35.
37. William Miller (ed.), *Men in Business: Essays in the History of Entrepreneurship* (Cambridge, 1952).
38. Valerie Muir, "The Emergence of State Enterprise in New Zealand in the Nineteenth Century," *E.E.H.*, Mar., 1953, pp. 186-97.
39. Milton J. Nadworny, *Scientific Management and the Unions, 1900–1932: A Historical Analysis* (Cambridge, 1955).
40. Harold C. Passer, *The Electrical Manufacturers, 1875–1900: A Study in Competition, Entrepreneurship, Technical Change, and Economic Growth* (Cambridge, 1953).
41. John Pelzel, "The Small Industrialist in Japan," *E.E.H.*, Dec., 1954, pp. 79-93.
42. Fritz Redlich, *The German Military Enterpriser and his Work Force: A Study in European Economic and Social History* (Wiesbaden, 1964-65).
43. ———, "Approaches to Business History," *B.H.R.*, Spring, 1962, pp. 61-70.
44. ———, "Innovation in Business: A Systematic Presentation," *Amer. J. of Econ. and Soc.*, 1950, pp. 285-91.
45. ———, "The Military Enterpriser: A Neglected Area of Research," *E.E.H.*, Apr., 1956, pp. 252-56.
46. Research Center in Entrepreneurial History, Harvard University, *Change and the Entrepreneur: Postulates and Patterns for Entrepreneurial History* (Cambridge, 1949).
47. Henry Rosovsky, "The Serf Entrepreneur in Russia," *E.E.H.*, May, 1954, pp. 207-33.
48. W. W. Rostow (ed.), *The Economics of Take-Off Into Sustained Growth* (N.Y., 1963).
49. John E. Sawyer, "Entrepreneurial Studies: Perspectives and Directions, 1948–1958," *B.H.R.*, Winter, 1958, pp. 434-43.
50. Joseph A. Schumpeter, "The Creative Response in Economic History," *J.E.H.*, Nov., 1947, pp. 149-59.
51. Stanley J. Stein, *The Brazilian Cotton Manufacture: Textile Enterprise in an Underdeveloped Area, 1850–1950* (Cambridge, 1957).
52. "A Symposium on the Aristocrat in Business," *E.E.H.*, Dec., 1953.
53. Lea E. Williams, "Chinese Entrepreneurs in Indonesia," *E.E.H.*, Oct., 1952, pp. 34-60.
54. R. Richard Wohl, "The Significance of Business History," *B.H.R.*, June, 1954, pp. 128-40.

DISCUSSION

EVSEY D. DOMAR: Professor Baumol's is a kind of a paper with which one can find few quarrels. If the entrepreneur is defined as an exceptional person who sees in the future what other people do not see, then he obviously cannot fit into economic models. If he behaved according to a model, Baumol would demote him from the position of an entrepreneur to that of a manager or even make him a common maximizer operating with known, at least in some probability sense, inputs and outputs. Naturally, exceptional vision of the future is not a sufficient condition for greatness, and for every business hero who made the grade and caught the scholar's eye, there must be scores of others who lost their shirts. But failure in one's own profession, as distinct from that in love, does not attract biographers, particularly if the failure takes place early in one's career before one had a sufficiently large fortune to waste. And yet the study of success only is likely to mislead (like the finding that a high percentage of great scientists had an unhappy childhood); instead, we should try to set up some hypotheses regarding the characteristics or components that give rise to an entrepreneur and then test these hypotheses against both successes and failures. Otherwise we'll continue repeating Schumpeter's tautology that an innovator is one who successfully innovates.

But perhaps the entrepreneur is not as important a person as Baumol suggests. That Solow and others have found a so-called "residual" accounting for the unexplained $87\frac{1}{2}$ percent of the rate of growth in per-hour output is rather irrelevant: we do not know how to allocate this $87\frac{1}{2}$ percent between the entrepreneur, on the one hand, and managers, engineers, and ordinary workmen on the other. Even Denison's detailed studies are of no use here. Perhaps the very magnitude of this figure—$87\frac{1}{2}$ percent—is suggestive of something heroic. But if the residual is computed along Leontief's lines (the Index of Structural Change), then it merely becomes the average relative change in thousands or even in millions of input coefficients, the change produced by many individuals most of whom do not aspire to entrepreneurial rank. I should admit, however, that our statistics may understate the importance of entrepreneurial activity because of their inadequate treatment of new products. But even with a generous correction, I still would not know how much credit to give to the entrepreneur: among other things, he has not yet been defined in an empirically meaningful manner.

But as usual, we can discuss a phenomenon long before we understand it. We cannot tell whether underdeveloped countries, about whom Baumol worries, really lack entrepreneurs as persons with specific traits, or whether those who do exist are prevented from functioning properly. Probably both, but an economist is more inclined to follow the second hypothesis because it is more operational. Here we can give a good deal of useful advice to a receptive government provided that its people approve of fortune-making.

Unfortunately, economic efficiency and justice seldom keep company, and societies frequently have to choose one or the other. Since justice is hard to resist, at least in words, the building of empires by entrepreneurs can be altogether unpopular. Only socialism promises economic justice and growth together, and although it frequently delivers neither, its impact has been sufficiently strong to make me doubt that there is much room for the traditional entrepreneur in many underdeveloped countries, particularly in Asia and Africa. Perhaps socialism will produce its own business heroes. It is interesting that while we have had a number of excellent studies of Soviet management in the aggregate, I have never seen one of a particular Soviet functionary who might deserve the title of an entrepreneur. Do these people exist, work, and function but remain unrecognized? With rent, interest, and profit now given full status in the Soviet Union, will the socialist entrepreneur, probably renamed the "organizer," come next?

EVERETT E. HAGEN: Economists, I think, are experiencing a growing realization of the importance of the entrepreneur in economic development. Professor Leibenstein's paper contributes to the discussion. His observation of the necessity to analyze the demand for and the supply of entrepreneurship gets at an important problem. William P. Glade[1] and John R. Harris[2] have set forth models of this supply and demand, though Glade's does not use these words. Careful attention to the identification problem will certainly be one necessary step in progress in the economic analysis of entrepreneurship.

Leibenstein's terminology is suggestive, but I think it has one important unfortunate connotation. He refers to the functions of entrepreneurship as gap-filling and input-completion. Ingenious and provocative as these conceptions of the function are, I think that they are likely to give rise to misconceptions. "Gap-filling" means filling the space between two existing structures, objects, or quantities, and implies that the nature of the structure that will fill the gap is predefined. Input completion implies that the inputs, partially unformed, are there. The use of these terms is likely to convey the impression that there exists a virtual set of arrangements, which the entrepreneur in a low-income country does not need to invent, but merely to discover or make actual.

It is important for the analysis of economic development to be clear that even though prior inventions in the West are available, increase in productivity in a present low-income country requires the creation of new functions relating inputs and outputs, not merely the imitation or application of ones already existing in the West. In spite of the opportunity to borrow technical principles and physical instruments from the West, the degree of innovation required to make them function effectively in a system for which they were not devised is such that the terminology of gap-filling seems to me to be likely to lead analysis down the wrong road. The problems are

[1] W. P. Glade, "Approaches to a Theory of Entrepreneurship Formation," *Explorations in Entrepreneurial History*, Spring/Summer, 1967, pp. 235–59.
[2] J. R. Harris, "Industrial Entrepreneurship in Nigeria" (doctoral dissertation, Northwestern University, 1967).

ones of relative factor prices, absence of an appropriate productive network, and social and cultural resistances.

Let me illustrate them by mentioning the problems to be solved in an apparently very simple change: the shift from a traditional bazaar to a fixed-price retail store. Parallel illustrations could be drawn from each stage in industrialization, technical advance in agriculture, or even the process of introducing the spade into a low-income tropical or subtropical society.

A bazaar handles unstandardized handworked products—shirts, blouses, sandals, small items of consumer equipment, etc.[3] They are non-uniform because traditional craftsman do not make standardized pieces. The bazaar dealer does not solicit business by competing in price with the dealer on either side of him, because it is impossible to establish a reputation for lower prices when goods are not standardized. Each sale transaction is a time-consuming process of haggling about the quality and price of the item. The haggling process is a source of pleasure to buyer and seller alike.[4]

A shift from this system to fixed price retailing will save much time. But the shift turns out to be complex. To sell at a fixed price, it is necessary to have standardized items. Otherwise the same haggling process will go on about whether this item is not a little poorer or a little less suitable and worth a little less than that one.

To obtain standardized items is not a simple matter. Geertz noted that in an Indonesian village a clear distinction was drawn between "old-fashioned" craftsmen, who could not follow a pattern, and "modern" ones, who could, and the latter were scarce. Even in Spain, in 1967, when Sears was searching out local suppliers, it ran into the same problem. "If a woman likes my sweaters," one producer said, "she knows what size she is."[5] The proprietor must therefore find suppliers who will give up old ways, and who have the skills and attitudes and the equipment to produce uniform items, and will do so for him on a continuing contract. Or he must set up his own shop, buy the sewing machines or precision tools, and find, train, and supervise workers—a task not necessarily to his taste.

The fixed price retailer must maintain a significantly larger stock of goods than the bazaar dealer, for he must have a stock of each size and variety instead of offering whatever lot he happens to have picked up recently. Hence he will need to put capital into a store building and shelving and probably showcases. This may mean straining his financial resources to finance one single large risky venture, learning inventory control, and learning also the pricing policies appropriate to the economics of overhead costs.

In principle, his fixed prices might be either lower or higher than those of the bazaar for similar products. Actually, he will not be able to attract his

[3] This description of the bazaar and the problems of shifting to a fixed-price store is condensed from E. E. Hagen, "The Significance of Entrepreneurship in Developing Societies," a paper presented at the Dec., 1967, convention of the A.A.A.S.

[4] The most detailed single description of the system is that in C. Geertz, *Peddlers and Princes* (Chicago, 1963).

[5] *Wall Street J.*, Mar. 27, 1967.

old bazaar trade, for those buyers like the bazaar and the challenge of
haggling. Hence, he must provide articles that 'will be attractive to an
emerging bourgeois class. To appeal to this trade, his articles must be of
better quality than those in the bazaar. In practice, they will have to be
higher priced. Unless he successfully identifies such a class of potential
customers and attracts them, his fixed-price store will fail.

One concludes that only a man of boldness, managerial talent, and good
judgment will succeed in the very considerable innovation involved even
in the apparently simple step of shifting from bazaar to fixed-price store.

The example illustrates an important point: that an economy is an eco-
nomic, technical, and social system, and any change will be change from
what is. The indigenous innovator has precious knowledge: he knows, in-
tuitively if not explicitly, why the present system works. His task of modi-
fying it to work more productively is not well described by any term that
is less broad than the familiar imprecise one: innovation.

ALEXANDER GERSCHENKRON: There is little I can find to quarrel with in
Professor Soltow's brief but surprisingly comprehensive and useful survey
of entrepreneurial research in economic history. But some amplifying re-
marks may be in order. Professor Soltow rightly refers to the considerable
variety of approaches that have been used by "entrepreneurial scholars."
Equally rightly, with reasonable forbearance, he has failed to mention some
more esoteric brands of entrepreneurial research. I am referring particu-
larly to attempts to mobilize the modern theories of personality formation
in conjunction with some sweeping historical generalizations in order to
explain the emergence of modern entrepreneurs and thereby the rise of
modern industrial economies. Probably the best that has come out from
these very ingenious but exquisitely nonoperational speculations is the
admission that "toilet training of infants is no longer to be regarded as the
almost absolute key" to the pertinent problems. On the other hand, Pro-
fessor Soltow does mention the sociological approach with its stress on
value systems, deviant behavior, social roles, and social sanctions. There is
no doubt that some interesting results were obtained in this fashion. At the
same time, it must be said that an approach which managed to ignore so
thoroughly the categories of power and interest inevitably failed to explain
the phenomenon of successful entrepreneurial activities in the most intrigu-
ing historical situations; that is to say, where the entrepreneurs were able
to assert themselves vigorously and successfully in the face of dominant
social beliefs that rejected those activities as incompatible with the tradi-
tional value system of the community.

Again, Professor Soltow is correct in mentioning Schumpeter's impact
upon entrepreneurial research through the importance which he attached
to the innovating role of the entrepreneur. Schumpeter himself, of course,
stood at the cradle of modern entrepreneurial explorations in the United
States. It is all the more surprising, therefore, that American research in
the field by and large has failed to draw to any significant extent on the
wealth of the Schumpeterian hypotheses and intuitions. This becomes very
clear if one compares the type of work performed here, interesting and re-
warding as it doubtless was, with what was accomplished by a gifted

Swedish scholar. It was Erik Dahmén who in his *magnum opus* addressed deeply probing questions to empirical Swedish material, questions designed to put Schumpeter's ideas to imaginative quantitative tests: To what extent was it true, as Schumpeter believed, that entrepreneurs originated indiscriminately in all strata of the society? Was it true that innovations were typically a product of new enterprises, while the old enterprises either were pressed and choked to death by the resulting geological shifts in the folds of the production functions, or else managed to be carried to the crest by Schumpeter's secondary wave? And as far as that tidal wave went, did it rise equally high and spread its waters equally far whether the innovating earthquake had occurred in the area of new products or of new methods of production? Was Schumpeter right in what he had to say about the impact of supply upon demand; that is to say, in Dahmén's language, to what extent was the innovating entrepreneur "market creating" or merely "market filling"? And what was the incidence of new versus old enterprises within the secondary wave? (It is true, of course, that Jacob Schmookler dealt with some of these problems in his excellent study, but he did not consider them in terms of the entrepreneurial approach and his inspirations certainly did not come from Schumpeter.)

To have placed these and other questions, as Dahmén did, within the framework of quantitative analysis with continuing stress on entrepreneurship was a most worthwhile achievement, and I am glad to hear that the American Economic Association is preparing for publication an English translation of Dahmén's work. It may be noted that Dahmén's findings are not always those one would have expected on the basis of Schumpeterian theories, which has more than merely negative significance: as regularly happens in research, the failure of a hypothesis is most likely to raise further intriguing problems as to the reasons for the failure. Nevertheless, Dahmén is a true Schumpeterian, one of the very few in the world, and one cannot quite spare those engaged in entrepreneurial research in the United States the reproach that although they have been so much more closely and directly exposed to Schumpeter's parturient mind, they have proved unwilling to proceed along the road that was so clearly lighted by the beacon of his thought. It is to be hoped, however, that once Dahmén's book has become available, it will belatedly stimulate similar empirical studies of American entrepreneurship. In so doing, the entrepreneurial economic historians may well pay heed to the fact that Dahmén did not simply consider the Schumpeterian hypotheses in isolation. He tried to place them within a broader view of economic development. In this way—a true disciple of the master—he tried to merge into intelligible unity long-run problems of economic development with those of the business cycle. And this is the area where a great deal, perhaps everything, still remains to be done by the adepts of entrepreneurial research.

Professor Soltow spoke of a general theory, and here again I can only approve his note of skepticism in this respect. What is a general

theory? It may be just as well to stop using the term. A truly general theory which knows no exogenous factors, where everything is interdependent, which explains, as Jacob Marschak likes to say, how you cannot touch a flower without moving a star, is beyond our ken. To speak of a general theory may flatter a scholar's ego, but should offend his sense of realism. We are at all times condemned to deal with partial theories, some of them more, some of them less partial. Rather than follow the will-o'-the-wisp of a "general theory of entrepreneurship," the interested scholars should try to do what should have been done a long time ago; that is to say, to ask economically significant questions and in this way try to integrate entrepreneurial research with the main body of economic thought. To give some random examples: Those concerned with the study of entrepreneurial attitudes in economic history could for instance ask questions about the more long-run effects of the business cycle upon those attitudes; to find out, that is, variations in the behavior of generations of entrepreneurs depending on whether their formative years of business experience fell into periods of depressions or upswings. Possibly, thereby some additional light could be shed on the mysterious and elusive problem of long waves. In studying long-term processes of economic development they could attempt to understand what happens to time horizons of entrepreneurs when the industrialist replaced the trader as a dominant figure on the economic scene. Similarly, a comparative study of time horizons of investment bankers and industrialists would be very much in order. Precisely in connection with time horizons much more could be done concerning the interrelationship between changing standards of commerical honesty and modern economic development. Attitudes to obsolescence and changes in those attitudes would be another promising area of study.

But in order to embark successfully upon such studies of entrepreneurial attitudes, also the attitude, or rather the orientation, of entrepreneurial economic historians must change. They should relax their concern with definitions and morphologies which, I believe, has been pushed rather far beyond the point of diminishing returns; they would do well not be to tempted so readily into the application of lifeless sociological schemes, to say nothing of excursions into shallow depth psychology; and above all they should develop more understanding for what rightly or wrongly has come to be known as "new economic history," taking the term in its broadest connotations. Constructive criticism and cooperation rather than hostile strictures and isolation is what is called for with regard to the exciting problems, the posing and the treatment of which has of late informed economic history with a new sense of importance and promise. There is little doubt that by establishing close intellectual contact with those who are trying to apply theoretical models in conjunction with quantitative analysis to historical problems entrepreneurial research could add very significant new dimensions to those problems. Should its adepts prove willing to do so, and I think I can discern some hopeful signs in this direction, then, let us say ten years from now, Professor Soltow in making another report to the Association on entrepreneurial research will no doubt have many more illuminating and in fact fascinating things to include in his survey.

ECONOMETRIC MODELS: THEIR PROBLEMS AND USEFULNESS

PITFALLS IN FINANCIAL MODEL BUILDING*

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Most monetary economists agree that the financial system is a complex of interrelated markets for assets and debts. The prices and interest rates determined in these markets and the quantities to which they refer both influence and are influenced by the "real economy," the complex of markets for currently produced goods and services. These interdependences are easy to acknowledge in principle but difficult to honor in practice, either in theoretical analysis or in empirical investigation. All of us seek and use simplifications to overcome the frustrating sterility of the cliché that everything depends on everything else. But we all know that we do so at some peril.

In this paper we argue for the importance of explicit recognition of the essential interdependences of markets in theoretical and empirical specifications of financial models. Failure to respect some elementary interrelationships—for example, those enforced by balance-sheet identities—can result in inadvertent but serious errors of econometric inference and of policy. This is true equally of equilibrium relationships and of dynamic models of the behavior of the system in disequilibrium.

We will try to illustrate the basic point with the help of computer simulations of a fictitious economy of our own construction. This procedure guarantees us an Olympian knowledge of the true structure that is generating the observations. Therefore, it can exhibit some implications of specifications and misspecifications that are inaccessible both to analytical inspection and to econometric treatment of actual data.

We fully realize, of course, that this procedure cannot tell us anything about the real world. You can't get something for nothing. We realize further that lessons derived or illustrated by simulations of our particular structure will not be very convincing or even interesting to people who believe that the model bears no resemblance to the processes which generate actual statistical data. We have tried to formulate a model we believe in qualitatively, though of course the numerical values of the parameters are arbitrary.

I. *An Equilibrium System*

We begin by setting forth the equations of a static equilibrium of a simple financial system. The model contains the following six assets: currency and bank reserves, Treasury securities, private loans, demand deposits, time deposits, equities. With each asset is associated an interest rate; some rates are market determined, some are policy variables, some are institutional constants. There are three sectors: government, commercial banks, public. The constituents of their balance sheets and the symbols used for them in the paper are given in Table 1.

The interest rates involved in the model are:

r_P central bank discount rate $\bar{r}_D$ demand deposit rate, legal ceiling (generally zero)

r_S Treasury security rate $\bar{r}_T$ time deposit rate, legal ceiling

r_L loan rate r marginal efficiency of real investment

r_K market yield on equity

TABLE 1

Debts of	Assets of			
	Government	Banks	Public	Total Debts
Government		S^B Treasury Bills	S^P Treasury Bills	$G-R$ Treasury Bills
		E Required Reserves Net Free Reserves	C Currency	R Reserves of Currency
Banks			D Demand Deposits T Time Deposits	D Demand Deposits T Time Deposits
Public		$-L$ Loans		$-L$ Loans
Equities in physical capital			V Equities	V Equities
Net worth assets—debts	$-G$ Government Debt	0	W^P Equities+ Government Debt	

r^P the vector of interest rates relevant to public portfolio decisions, $(r_S, r_L, \bar{r}_D, \bar{r}_T, r_K)$.

r_B the vector of interest rates relevant to banks' asset choices, (r_P, r_S, r_L).

In addition to the interest rates and the accounting variables of Table 1, the following symbols are used:

p the market valuation of equities; the replacement value of the physical assets to which the equities give title is taken to be 1 and serves as the numeraire of the system;

K the stock of capital at replacement cost;

Y national income;

k_D and k_T required reserve ratios for demand and time deposits, respectively.

$I = \Delta K$ net investment at replacement cost

H private saving

GP government purchases

$\overline{tx}$ the marginal tax rate.

The equations are:

Public asset holdings and debts

$$[C = C^P(p^P, Y)W^P \qquad \text{Currency] (Assumed zero in simulation model)}$$

(1) $D = D^P(p^P, Y)W^P$ Demand deposits

(2) $T = T^P(p^P, Y)W^P$ Time deposits

(3) $S^P = S^P(p^P, Y)W^P$ Treasury securities

(4)$-L = -L^P(p^P, Y)W^P$ Borrowing

$$[V = V^P(p^P, Y)W^P \qquad \text{Equities}$$
$$= (1 - L^P - S^P - T^P - D^P - C^P)W^P] \quad \text{[implied by other equations]}$$

Bank asset holdings

(5) $E = E_D^B(p^B)(1 - k_D)D + E_T^B(p^B)(1 - k_T)T$ Net free reserves

(6) $S^B = S_D^B(p^L)(1 - k_D)D + S_T^B(p^L)(1 - k_T)T$ Treasury securities

(7) $L = L_D^B(p^B)(1 - k_D)D + L_T^B(p^B)(1 - k_T)T$ Loans
$$= (1 - E_D^B - S_D^B)(1 - k_D)D + (1 - E_T^B - S_T^B)(1 - k_T)T$$

Balance equations

(8) $k_D D + k_T T + E + C = R$ Currency and bank reserves

(9) $S^P + S^B = G - R$ Treasury securities

$[L^P + L^B = 0 \quad \text{implied by (4) and (7)]}$ Loans

(10) $V = pK$ Market value of equity

(11) $W^P = G + V$ Public wealth

(12) $pr_K = r$ Yield and value of equity

(13) $r = \alpha_0 + \alpha_1 \dfrac{Y}{K}$ Relation of marginal to
                                                  average product of capital.

In addition, two inequalities must be satisfied in order for the ceiling rates on deposits to be effective. Banks must be willing to accept demand and time deposits at prevailing interest rates in at least as large volume as the public wishes to hold.

The thirteen equations (leaving aside public currency holdings) determine 7 quantities $(D, T, S^P, S^B, L, E, V)$, four rates (r_S, r_L, r, r_K), the market value of equity p, and of wealth W^P. Exogenous variables are of two kinds: policy variables $r_F, \bar{r}_T, R, k_D, k_T$ and other variables G, K, α_0, Y. Alternative interpretations are possible, depending on the *modus operandi* or objectives of the central bank. Although the supply of reserves R is one of the quantities the central bank directly controls, it may nevertheless be an endogenous variable and r_S an exogenous one if the central bank supplies whatever reserves are needed to peg the market interest rate at some target level.

A number of the features of this model need explanation:

1. The structure of the balance sheet desired by the public is taken to depend on the vector of relevant interest rates and on its net worth W^P in a special way. Desired holdings of the various assets and debts are homogeneous in wealth; a change in W^P with given interest rates changes all items in the balance sheet in the same proportion. With respect to interest rate effects, the assets are assumed to be gross substitutes. An increase in the rate on a particular asset increases the public's demand for the asset but diminishes or leaves unchanged its demand for any other.

2. Similar behavior is assumed of banks with regard to the allocation of their "disposable assets"—deposits less required reserves—among net free reserves,[1] government securities, and loans. However, allowance is made for possible differences between the allocations of disposable demand deposits and disposable time deposits. Since time deposits are, from the individual banker's viewpoint, less volatile than demand deposits, they may be more adventurously invested.

The vector of interest rates relevant to the banks is somewhat different from the one relevant to the public. It includes the central bank discount rate, which is irrelevant to the public, but excludes the rate on equities, which the banks do not hold. It is also assumed, though this is not essential, that asset allocations of deposits are independent of the rates that are paid to depositors.

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[1] Bank's net free reserves are equal to excess reserves less debt to the central bank; the model does not attempt to explain the two items separately.

3. In each case, banks and public, the entire list of relevant interest rates occurs in each equation. The reason for this is as follows: The total effect of an interest rate change, summed over the whole portfolio or balance sheet, must be zero. Thus if a particular rate is entered only as a positive factor in the demand for its own asset and not included in any other equation, the offsetting negative effect is being implicitly assigned to the missing equation. (In the above model, bank demand for loans and public demand for capital play this residual role.)

It is always important to check the specification of the unwritten equation that is implied by the explicit specification of the others. For example, one might be tempted, either because it is theoretically convenient or because of econometric results and significance tests, to regard the time deposit interest rate as important for time deposits but of negligible importance in public demand for any other particular asset—demand deposits, currency, securities, loans. But to drop it out of those equations is to assume that all the funds attracted into time deposits come from equities. If this is an assumption one would not make deliberately, neither should he make it inadvertently. It is quite possible that cross-effects are so diffused that none of them appears significant in empirical regressions. Yet it is a mistake to drop them out, because their sum is not zero but equal in absolute value to the own-effect.

4. The same observation applies to other variables affecting balance-sheet or portfolio choice. In the model, income Y is entered to represent the standard influence of transactions volume on desired holdings for demand deposits and for currency. By the same token, Y belongs in the other asset demand functions of the public. If an increase in income induces the public to add to their money holdings, it induces them to diminish their holdings of something else. If this something else is not specified, the implicit assumption is that all the movement into cash is at the expense of the residual asset, the one whose equation is not written down.

5. The influence of Y on asset choice is one causal link from the real economy to financial markets. An additional link is the influence of r, the marginal efficiency of capital, another variable exogenous to the financial sector. An increase in r, for example, will raise either the market value of equities, and with it the public's wealth, or the market yield of equities, or both. In any event it will lead to a general reshuffling of portfolios, and a new structure of rates. The marginal efficiency of capital itself is linearly related to its average product Y/K; both Y and K are exogenous to the financial sector.

6. One of the basic theoretical propositions motivating the model is that the market valuation of equities, relative to the replacement cost of the physical assets they represent, is the major determinant of new

investment. Investment is stimulated when capital is valued more highly in the market than it costs to produce it, and discouraged when its valuation is less than its replacement cost. Another way to state the same point is to say that investment is encouraged when the market yield on equity r_K is low relative to the real returns to physical investment.

An increase in p, the market valuation, can occur as a result of an increase in the marginal efficiency of capital r; i.e., as a result of events exogenous to the financial sector. But an increase in p may also occur as a consequence of financial events that reduce r_K, the yield that investors require in order to hold equity capital. Indeed, this is the sole linkage in the model through which financial events, including monetary policies, affect the real economy. In other words, the valuation of investment goods relative to their cost is the prime indicator and proper target of monetary policy. Nothing else, whether it is the quantity of "money" or some financial interest rate, can be more than an imperfect and derivative indicator of the effective thrust of monetary events and policies. As some of our examples below will show, such indicators can be quite misleading.

In the actual economy, of course, the single linkage just described is a multiple one. There are many kinds of physical capital and many markets where existing stocks are valued—not just markets for equities, but other markets for operating businesses and for houses, other kinds of real estate, cars and other durable goods, etc. The value of these stocks then helps to determine the profitability of new production of the same kind of capital or of close substitutes. Here this variety is ignored by aggregating all capital and attributing to it a single market price and a single replacement cost.

7. The effects of changes in Regulation Q ceiling rates on time deposits have been much debated in recent years, among both monetary theorists and men of affairs. In our view this discussion has not paid enough attention to the general equilibrium effects of such regulatory measures and has been too preoccupied with the effects on commerical bank loans or deposits. A reduction in the ceiling may in some circumstances be deflationary, but the fact that it drives funds out of banks and forces them to contract their loans is no proof at all of this assertion. Erstwhile depositors will be looking for places to invest their funds, and they may be glad to acquire, either directly or through other intermediaries, the assets the banks have to sell and to accommodate the borrowers the banks turn away. Whether the ultimate result is to bid interest rates and equity yields down or up is a complicated question: the answer depends, among other things, on whether time deposits are in wealth-owners' portfolios predominantly substitutes for demand

deposits and currency or for loans and equities. The former substitution pattern tends to make a reduction in time deposit rates deflationary, the latter pattern, expansionary. The answer depends also, of course, on what is assumed about the supply of unborrowed reserves and other instruments of monetary control.

For some purposes it will be useful to make explicit the connections between the financial system and the real economy, extending the model to encompass endogenous determination of income, investment, and the marginal productivity of capital. Our extensions are of the most primitive sort; our purpose is not to build a complete model but include the linkages necessary to illuminate the problems of constructing a model of the financial sector. The explicit equations, (14), (15), and (16), are given below in Section III-7. Net investment depends, for the reasons already stated, on the market value of capital, p. The model is a stationary one—alternatively, it could be interpreted to describe deviations from trend. In an equilibrium with $p = 1$, net investment will be zero. Government expenditures are exogenous; tax revenues and saving are linear functions of income; the level of income is determined by the usual multiplier process. The marginal productivity of capital has an exogenous component but also varies directly with income. Both income and the marginal productivity of capital feed back into the equations of the financial sector in the manners already described. The model does not determine a commodity price level; everything is expressed in terms of newly produced capital goods, the numeraire.

II. *Dynamics of Adjustment*

No one seriously believes that either the economy as a whole or its financial subsector is continuously in an equilibrium. Equations like those of the model described above do not hold every moment of time. Consequently analysts and policy-makers can hope to receive no more than limited guidance from comparative static analysis of the full effects of "changing" exogenous variables, including the instruments of policy. They need to know also the laws governing the system in disequilibrium. Since there are many dynamic specifications that have the same static equilibrium, the model builder has great freedom. Moreover, economic theory, although it imposes some a priori constraints on specification of equilibrium models, has almost nothing to say on mechanisms of adjustment. The burden on empirical testing and estimation is very heavy, but it is precisely in the estimation of lag strictures and autoregressive effects that statistical and econometric techniques encounter greatest difficulties.

There are, of course, some identities—e.g., balance-sheet or income identities—that apply out of equilibrium as well as in. Our structures in

Section I on the need for model builders to pay explicit attention to these identities apply with equal force to dynamic specifications. A common and useful dynamic equation is that the deviation of a variable from its "desired level"—i.e., its value according to one of the equations of the equilibrium model—is diminished by a certain proportion each unit of time. This specification is incomplete when the model includes a number of such variables constrained to add up to a given total, the same total for actual values and desired values. Deviations of actual from desired values must always add up to zero. If, for example, the public is raising its holdings of demand deposits to bring them closer to the quantity desired at current levels of income and interest rates, the public must also be reducing its holdings of some other assets, taking those holdings either toward or away from equilibrium.

In general, the adjustment of any one asset holding depends not only on its own deviation but also on the deviations of other assets. The public might have exactly the right amount of demand deposits and yet change this holding in the course of adjusting other holdings to their desired levels. Failure to specify explicitly these dynamic cross-adjustment effects has the unintended consequence that they are all thrown into the omitted equation. In the model of Section I, for example, the equity equation happens to be the one which is arbitrarily omitted, since by Walras' law its specification is implicit in the other equations. If no cross-effects were allowed in the explicit equations of adjustment of the other asset demands, then the counterparts of all the own-adjustments specified would be loaded into the implicit adjustment equation for equities. The assumption would be, for example, that when people increase their demand deposits to bring them up to desired levels they get all the funds by selling equities. It is doubtful that a model builder would want to make an assumption of this sort, but he might do so inadvertently.

The necessity for the effects of a change in a variable to sum to zero across an exhaustive list of asset holdings applies separately to every lagged value introduced as an explanatory variable. Model builders are tempted, of course, to choose for each equation, one at a time, the lag structure that seems best to fit their commonsense judgments and the data. They should remember that they are implicitly building the reflection of this lag structure into other equations. For example, it would be hard to make sense of a model that relates one asset holding to interest rates lagged two and three quarters and relates a close substitute to the same interest rate lagged one and four quarters.

We are pleading, in short, for a "general disequilibrium" framework for the dynamics of adjustment to a "general equilibrium" system. This is the spirit in which the simulation model, described in the next section, has been constructed.

TABLE 2

DESIRED BALANCE SHEET OF PUBLIC

Coefficients of:	Const.	r_T (Time Deposits)	r_S (Securities)	r_L (Loans)	r_K (Equities)	Y (Income)	
C^{**}/W^P	0	0	0	0	0	0	Currency*
(1) D^{**}/W^P	.55	$-.20$	$-.10$	0	0	.10	Demand Deposits
(2) T^{**}/W^P	$-.05$	.40	$-.20$	0	0	$-.03$	Time Deposits
(3) S^{P**}/W^P	.20	$-.15$	.40	0	$-.025$	$-.05$	Treasury Securities
(4) L^{**}/W^P	0	0	0	.20	$-.125$	$-.05$	Loans (in negative sense)
V^{**}/W^P	.30	$-.05$	$-.10$	$-.20$	$+.15$	.03	Capital
Totals	1.00	0	0	0	0	0	

* Public is assumed not to hold currency.

III. *Description of the Structure of the Model*

The model which has been simulated is as follows:

1. *Public's Desired Balance Sheet.* Each desired asset holding is of the form $X^P = (a_0 + a_1 r_T + a_2 r_S + a_3 r_L + a_4 r_K + a_5 Y) W^P$. The assumed coefficients of the linear forms are given in Table 2; we do not attempt to defend the realism of these numbers or the ones in later tables. We shall designate by $X^{**}(t)$ the value of X^P which this function yields for contemporaneous r's, Y, and W^P. The sum of X^{**}/W^P must be identically equal to 1; therefore, the constant terms must add up to 1 and the other coefficients to 0. Own-rate coefficients in each case are shown in squares.

2. *Public's Adjustment Behavior.* This is assumed to take the following form

$$\Delta X_i(t) = X_i(t) - X_i(t-1) = \sum_j \alpha_{ij}(X_j^{**}(t)$$
$$- X(t-1)) + \beta_i H(t) + \gamma_i K(t-1)\Delta p(t).$$

The first terms simply represent the stock adjustment terms previously discussed, including "cross" as well as "own" terms. The last two terms represent initial allocations of new saving $H(t)$ and of capital gains on equities $K(t-1)\Delta p(t)$. Together these two variables account for the change in public wealth $\Delta W^P(t)$. As the column sums of Table 3 indicate, the sum of the reactions to a particular deviation, with wealth

TABLE 3

ADJUSTMENT BEHAVIOR OF PUBLIC

Coefficient of:	Deviation from Desired Stocks				Changes in Wealth	
	Demand Deposit $D^{**}(t)-D(t-1)$	Time Deposit $T^{**}(t)-T(t-1)$	Securities $S^{P**}(t)-S^P(t-1)$	Loans $L^{**}(t)-L(t-1)$	Saving $H(t)$	Capital Gains $K_{t-1}(p_t-p_{t-1})$
$(1')\Delta D(t)$	+.30	−.08	−.08	−.30	1.00	0
$(2')\Delta T(t)$	−.10	.20	−.10	0	0	0
$(3')\Delta S^P(t)$	−.15	−.10	.20	0	0	0
$(4')\Delta L(t)$	0	0	0	.40	0	0
$\Delta V(t)$	−.05	−.02	−.02	−.10	0	1.00
Totals	0	0	0	0	1.00	1.00

constant, must be 0, and the sum of the reactions to a change in wealth must be 1.

There are five deviations $X^{**}(t) - X(t-1)$ and two wealth increments $H(t)$ and $K(t-1)\Delta p(t)$. But they are linearly dependent: the sum of the five deviations must equal the sum of the two wealth increments. Therefore, there are only six identifiable coefficients, not seven in each ΔX adjustment equations. We have chosen to leave out $V^{**}(t) - V(t-1)$, which can be derived as the sum of the last two variables—column headings in Table 3—less the sum of the first four. Therefore, each of the first four columns of Table 3 describes the pattern of reactions to a unit deviation in the designated variable offset by a unit deviation of opposite sign in equity holdings. Likewise, each of the last two columns describes the pattern of reactions to a unit increment of wealth matched by a unit deviation of the same sign in equity holdings.

The numerical values in the table embody some preconceptions of the authors. One is that new saving is initially accumulated as demand deposits, later to be distributed among other assets if holdings of demand deposits are too large. Another is that capital gains are initially held in the assets that gave rise to them; later they may be at least partially realized and distributed across the whole portfolio. The fourth column has the following interpretation: If people are in debt more than, they like (and have equivalently more equity capital than they would like), they repay 40 per cent of the excess, selling equities for 1/4 of the repayment and using demand deposits for the other 3/4. Conversely, if their debt is less than desired, they borrow 40 percent and divide the newly borrowed funds in the same one-to-three ratio between equities and cash. Subsequently the borrowed money finds its way into equities, which the equilibrium equations tell us is the purpose of incurring debt.

3. *Banks' Desired Allocation of Deposited Funds.* As explained in Section I, banks accept as given and beyond their control the quantities of time and demand deposits forthcoming at the ceiling rates. They allocate these deposits, after meeting the reserve requirements upon them, among excess reserves, securities, and loans. These allocations are not the same for the two kinds of deposits; banks are more willing to lend out their time deposits, which are regarded as less likely to be withdrawn. The form of the equation for banks' desired holding of an asset is $X^B = (1 - k_D) D\{a_D + a_1(r_S - r_F) + a_2(r_L - r_F)\} + (1 - k_T)T\{a_T + a_1(r_S - r_F) + a_2(r_L - r_F)\}$. We shall call the value of X^B for contemporaneous values of interest rates and deposits $X^*(t)$.

4. *Bank's Adjustment Behavior.* The dynamics of bank behavior are similar in structure to the dynamics of public portfolio adjustment. Changes in bank portfolio allocations depend, on the one hand, on deviations from desired allocations and, on the other hand, on changes in dis-

TABLE 4

DESIRED PORTFOLIO OF BANKS

	Constants		Coefficients of Differentials Above Discount Rate		
	a_D Demand Deposits	a_T Time Deposits	a_1 Securities Rate $r_S - r_F$	a_2 Loan Rate $r_L - r_F$	
(5) E^*	.01	0	$-.04$	$-.01$	Net free reserves
(6) S^{B*}	.67	$..34$	$+.06$	$-.09$	Treasury securities
(7) $-L^*$	.32	.66	$-.02$	$+.10$	Loans
Totals	1.00	1.00	0	0	

posable deposits. The assumed structure of the former responses is given in the first two columns of Table 5, for net free reserves and securities. A unit deviation in either of these has as its counterpart a unit deviation of opposite sign in loans.

The structure of responses to changes in disposable assets is given in columns 3 and 4; very simply, all changes are initially absorbed in net free reserves. As indicated in those columns, disposable assets may change either because deposits change or because reserve requirements are altered. Reserve requirement changes also figure in column 1: banks are assumed to realize, for example, that net free reserves of last period are already less excessive if reserve requirements have meanwhile been increased.

Finally, the last row and column of Table 5 recognize that in the short run banks meet from excess reserves whatever loan demand comes their way at the established interest rate. However, banks adjust the loan

TABLE 5

ADJUSTMENT BEHAVIOR OF BANKS

Coefficients of:					Changes in Loan Demand
Deviation from Desired Stocks		Changes in Disposable Assets			
Net free Reserves	Treasury Securities	Demand Deposits	Time Deposits		
$E^*(t) - E(t-1)$ $+\Delta k_D D(t-1)$ $+\Delta k_T T(t-1)$	$S^{B*}(t) - S^B(t-1)$	$(1-k_D)\Delta D$ $-\Delta k_D D(t-1)$	$(1-k_T)\Delta T$ $-\Delta k_T T(t-1)$		$-\Delta L$
(5′) ΔE .5	$-.5$	1	1		-1
(6′) ΔS^B $-.5$	.5	0	0		0
$-\Delta L$ 0	0	0	0		1
Totals 0	0	1	1		0

rate up or down, depending on whether $L^*(t) - L(t-1)$ is greater or smaller than zero:

$$(7') \qquad \Delta r_L = 10 \left\{ \frac{L^*(t) - L(t-1)}{(1 - k_D) D(t-1) + (1 - k_T) T(t-1)} \right\}$$

This is the *modus operandi* of the loan market and determines the loan rate. There are two other balance equations, one for bank reserves (currency) and one for interest-bearing government debt. These equations determine the two remaining interest rates, on securities and equities. These must adjust contemporaneously as necessary to clear these markets.

$$(8) \qquad E(t) + k_D D(t) + k_T T(t) = R(t) \qquad \text{Reserves}$$

$$(9) \qquad S^P(t) + S^B(t) \qquad\qquad = G(t) - R(t) \qquad \text{Securities}$$

As in the static model, we have equations for the market value of the capital stock and for total public wealth:

$$(10) \qquad V(t) = p(t) K(t)$$

$$(11) \qquad W^P(t) = G(t) + V(t)$$

5. *Market Value of Equity.* As explained in Section I, there is an inverse relation (12) between the market value of equity and the return it bears. Their product is equal to the marginal productivity of capital, r. This in turn was assumed to be positively and linearly related to the average product capital; in the dynamic version this relation is lagged.

$$(12) \qquad r_K(t) p(t) = r(t)$$

$$(13') \qquad r(t) = \alpha_0 + \alpha_1 \frac{Y(t-1)}{K(t-1)}$$

In some simulation runs α_0 is varied in a cyclical pattern in order to "drive" the economy. Two pairs of normal values of (α_0, α_1) are used— one is (9,2.5) and the other (8,5). The second gives a more powerful endogenous determination of r. Since the equilibrium value of the average product of capital is taken to be .4, the equilibrium value of marginal productivity is in both cases 10 (percent).

6. *Changes in Wealth.* Equation (11) implies that $\Delta W^P(t) = \Delta V(t) + \Delta G(t)$. Likewise, equation (10) says that $\Delta V(t)$ may be the result either of real investment $I(t) = \Delta K(t)$ or of capital gains or losses on existing capital. The allocation of changes in wealth between saving ($H(t) = \Delta G(t) + p(t) I(t)$) and capital gains makes a difference in the adjustment process—see Table 3.

The 13-equation static model has now been augmented by the seven

adjustment equations (1') through (7'). Correspondingly, actual values of the seven quantities are augmented by seven desired levels D^{**}, T^{**}, SP^{**}, L^{**}, E^{*}, S^{B*}, L^{*}.

The model so far described tells how the financial system operates in response to monetary policy changes or to other shocks arising either inside the financial sector or in the real economy. This model can trace the effects of these shocks on time paths of interest rates, financial quantities, and the market valuation of capital. Among the variables whose time paths are treated as exogenous to the financial system are income Y, the exogenous component of marginal efficiency of capital α_0, the real capital stock K, the government debt G.

In a rough sense, this model is analogous to the LM sector of the textbook Keynes-Hicks macroeconomic model. That is, it tells what interest rates will be associated—via monetary and financial institutions, markets, and behavior—with different states and paths of income and other "real economy" variables.

7. *The Model Extended to Endogenous Determination of Income.* As noted in Section I, we have also constructed a primitive extension of the model to allow for endogenous determination of income. The dynamic version of this extension consists of the following equations:

(14) $Y(t) (1 - c(1 - \overline{tx})) = c_0 + \Delta K(t) + GP(t)$

This is the conventional multiplier relation. Here c is the marginal propensity to consume from disposable income, c_0 is the consumption intercept, $\overline{tx}$ is the marginal tax rate, and GP is government purchases. No lags are introduced; (14) holds for contemporaneous values of the variables.

(15) $\Delta G(t) = GP(t) - \overline{tx} Y(t) - \overline{tx}_0$

The increase in government debt is identical to the budget deficit, which is the excess of government purchases over tax revenue. Tax revenue is a linear function of income.

(16) $\Delta K(t) = \gamma_0(p(t) - 1) + \gamma_1(p(t - 1) - 1)$

As explained in Section I, the valuation of equity is the channel through which financial policies and events are transmitted to the real economy. Equation (16) expresses this linkage. In one numerical version (γ_0, γ_1) is $(1.5, 0)$; in an alternative version (γ_0, γ_1) is $(1.5, 1.5)$. These three equations convert Y, G, and K into endogenous variables and introduce GP, tx_0 and $\overline{tx}$ as new policy parameters.

The extended model can be driven by three kinds of shocks (a) exogenous changes in r—i.e., changes in the α_0 part of r, (b) monetary instruments, in particular changes in R, the supply of bank reserves, and (c)

fiscal policy, represented by variation of government purchases *GP* while tax rates remained constant.

IV. *Description of Simulations*

The dynamic systems described in Section III are systems of simultaneous nonlinear first-order difference equations in 20 or 23 variables. There are three such systems: one for the financial sector alone, and two variants of the extended model, with "weak investment" and "strong investment" responses to changes in income Y. Simulations of the following types have been run:

1. *Unit Impulses.* The system is displaced from equilibrium by a once-for-all increase of 10 percent in a single exogenous variable, holding all others at their initial equilibrium values, and the paths of the endogenous variables to the new equilibrium are traced.

2. *Exogenous Cycles.* The system is displaced from equilibruim by a sinusoidal fluctuation in a single exogenous variable, with a period of 24 units of time. At its peaks the variable is 5 percent above, at its troughs 5 percent below, its initial value.

There are both monetary cycles, in which the driving force is R, the supply of unborrowed reserves, and nonmonetary cycles. In the several nonmonetary cycles, the driving forces are GP, government purchases, and r, the marginal efficiency of capital or its exogenous component α_0. There are two kinds of nonmonetary cycles, corresponding to alternative assumptions about the behavior of the central bank. In one set of simulations, the monetary authority holds R constant and lets interest rates fluctuate. In another set, the monetary authority desires to peg the Treasury security rate, and therefore engages heavily in open market operations designed to keep the rate on target.

The results of these simulations are summarized in the Appendix tables. They form the basis for some observations in the subsequent sections of this paper.

V. *Equilibrium Responses, Financial Sector*

The comparative static properties of the model, a number of which were discussed qualitatively in Section I, are illustrated in Table A-1. How to read it may be explained by reference to the first column, which concerns the ultimate effects of a 10 percent or .17 change in unborrowed bank reserves R, accomplished by open market operations. Note that the public eventually sold not only .17 securities to the central bank but another .34 to the banks. With the reserve requirements in force, the increase in reserves could legally have supported an expansion of 1.13 in demand deposits or 3.40 in time deposits, or any linear combination. However, this does not happen. Both demand and time deposits have

TABLE A-1
FINANCIAL SECTOR MODEL
Equilibrium Responses to Once-for-all 10% Increases in Single Variables
(units in upper left of cell; elasticity in lower right)

Shock and Amount / Variable	Reserves R .17	Government Debt G .75	Real Capital K 1.25	Preferences for Demand Deposits from T^{**} .70	from S^{**} .70	from K^{**} .70	from L^{**} .70	Marg. Prod. r 1.0	Income Y 0.5	Reserve Requirements Demand Deposits h_D 1.5%	Time Deposits h_T 0.5%	Ceiling Rate R_T .25
Demand deposits D	.30 / .43	.15 / .21	.57 / .82	.53 / .76	.45 / .65	.41 / .59	.46 / .66	.19 / .27	.73 / 1.05	−.18 / −.26	−.07 / −.10	−.94 / −1.35
Time deposits T	.54 / .69	.10 / .13	.52 / .66	−.88 / 1.12	−.38 / −.48	−.36 / −.46	−.31 / −.40	.20 / .25	−.71 / −.90	−.30 / −.38	−.12 / −.15	2.04 / 2.54
Security holdings S^P	−.51 / −1.92	.67 / 2.52	.47 / 1.76	.08 / .30	−.09 / −.34	.08 / .30	.16 / .60	.18 / .68	.05 / .19	.26 / .97	.09 / .34	−.31 / −1.18
Loans $-L$	.33 / .33	.18 / .18	1.58 / 1.58	−.26 / −.26	−.01 / −.01	.14 / .14	.32 / .32	.57 / .57	.08 / .08	−.22 / −.22	−.10 / −.10	.79 / .79
Excess reserves B	.10 / (n.a.)	−.02 / (n.a.)	−.11 / (n.a.)	−.04 / (n.a.)	−.05 / (n.a.)	−.04 / (n.a.)	−.05 / (n.a.)	−.04 / (n.a.)	−.07 / (n.a.)	−.06 / (n.a.)	−.02 / (n.a.)	.04 / (n.a.)
Bank securities S^B	.34 / 1.09	.08 / .26	−.47 / −1.50	−.09 / −.29	.09 / .29	−.09 / −.29	.16 / .51	−.18 / −.58	−.05 / −.16	−.26 / −.83	−.09 / −.29	.31 / .99
Security rate rS	−.09 / −.46	.06 / .30	.09 / .44	.02 / .10	.08 / .39	.04 / .20	.04 / .20	.03 / .15	.09 / .44	.05 / .24	.02 / .10	.04 / .20
Yield on capital rK	−.25 / −.24	−.03 / −.03	1.16 / 1.13	.27 / .26	.18 / .18	.49 / .48	.38 / .37	.46 / .45	.32 / .31	.20 / .20	.08 / .08	−.31 / −.30
Loan interest rL	−.20 / −.38	.04 / .08	.63 / 1.22	.20 / .38	.10 / .19	.20 / .39	.28 / .54	.24 / .47	.28 / .54	.14 / .27	.05 / .10	−.34 / −.66
Equity value* ρ	.02 / .20	+.00 / +.00	−.13 / −1.30	−.03 / −.30	−.02 / −.20	−.05 / −.50	−.04 / −.40	.05 / .50	−.03 / −.30	−.02 / −.20	−.01 / −.10	.03 / .30

* Numbers are inexact because changes in β were reported only to one significant figure.

elasticities less than one (.43 and .69) with respect to reserve changes, and their total increase is only .84. Banks keep .10 of the new reserves idle. Even so, the public has considerably reshuffled its wealth, selling securities and borrowing as the counterpart of their increased deposits. Their portfolio shifts, and their counterparts in the banks' portfolios, are induced by a general reduction in interest rates, with which goes an increase in the valuation of equity capital p. Thus the column says that open market purchases have an effect in the expected expansionary direction.

The other columns are to be interpreted similarly. A number of propperties of the model worth noting are illustrated in Table A-1:

1. In several instances D and p move in opposite directions, and increases in D accompany increases rather than reductions in interest rates. Thus column 3 concerns an increase in wealth which takes the form entirely of equity capital; no government debt in monetary or other form is provided to balance it. As might be expected, this is highly deflationary. But the public does acquire more bank deposits, and the banks are induced by higher interest rates to cut their excess reserves drastically.

Columns 4 to 7 concern 10 percent increases in demand deposits as a result of autonomous changes in asset preferences, the shift in each case coming from the asset indicated. All such shifts are of course deflationary, even though demand deposits increase and satisfy partially the public's desire to hold more of them. Banks are again induced to economize reserves by increases in interest rates.

2. Changes in excess reserves are also an unreliable guide to the thrust of the financial system, as measured by p. When monetary policy is expansionary, excess reserves go up along with p. When, as in column 8, nonmonetary events are raising both p and the demands on the banking system, net free reserves fall.

3. Although interest rates move together in all the cases in Table A-1, they too can be misleading indicators. Consider, for example, an autonomous shift from securities into capital, whose effects could be calculated by subtracting column 6 from column 5. Then r_S would rise by .04, r_K would fall by .21 and p would rise.

In Table A-2 the equilibrium responses of the endogenous variables to three exogenous variables, Y, G, and R are compared to the relative amplitudes of the same endogenous variables in cycles driven by the same three exogenous variables. Thus demand deposits had a relative amplitude 1.07 times as large as income in an income-driven cycle; this compares with a comparative-statics elasticity of 1.03. The table shows that for some variables such elasticities are a misleading indicator of cyclical sensitivities. The magnitude of the cyclical fluctuations in T, for

TABLE A-2

FINANCIAL SECTOR MODEL

Amplitude (Peak less Trough) Relative to Amplitude of Driving Force
(10% of equilibrium value) (Equilibrium Elasticities—
absolute values)—from Table 1 in parentheses)

Variable	Exogenous cycles in:			
	Income Y	Income Y, Investment ΔK*	Government Debt G	Reserves R
Demand deposits D	1.07 (1.05)	3.20	.40 (.21)	.46 (.43)
Time deposits T	.60 (.90)	.34	.34 (.13)	.39 (.69)
Security holdings S^P	.53 (.19)	3.24	2.34 (2.52)	1.73 (1.92)
Loans $-L$	.25 (.08)	2.31	.06 (.18)	.17 (.33)
Excess reserves E†	.09 (.07)	.33	.03 (.02)	.13 (.10)
Banks' reserves S^B	.45 (.16)	2.78	.48 (.26)	1.03 (1.09)
Security rate r_B	.39 (.44)	.49	.44 (.30)	.39 (.46)
Yield on capital r_K	.32 (.31)	2.92	.17 (.03)	.37 (.24)
Loan interest r_L	.45 (.54)	2.04	.08 (.08)	.41 (.38)
Equity value p	.20 (.30)	2.70	.20 (+.00)	.40 (.20)

* In this simulation ΔK was always 1/2 (actual Y—equilibrium Y), corresponding to a multiplier of 2; the capital stock varied accordingly, whereas in column 1 the capital stock is held constant.
† Amplitudes given in units.

example, is on the order of two-thirds its equilibrium response for both the Y and R cycles. On the other hand, in the Y cycle, the security holdings of both the banks and the public fluctuate more than two and a half times their equilibrium response. Similarly, fluctuations in bank reserves cause bigger fluctuations in r_K and p than would be expected from the corresponding once-for-all elasticity. This suggests that it may be difficult to obtain accurate estimates of the demand relationships from cyclical data.

VI. Adjustment Speeds

The speed with which a simultaneous difference equation model returns to equilibrium when subjected to a change in an exogenous variable cannot be inferred by inspection of individual behavioral equations. Systems with slow adjustment in individual behavioral equations may move quickly to a new equilibrium, and systems incorporating rapid adjustment in individual equations may be slow to reach a new equilibrium. This reflects two features of a "general disequilibrium" system.

First, some variables can be taken as given by individual decision-makers or in particular markets but are endogenous to the system as a whole. Slow response of individuals in one dimension may merely result in a compensating large and rapid adjustment of other endogenous variables. This process may get the system to equilibrium in a short time.[2]

Second, adjustments made in one market, while moving it towards equilibrium, may move other markets away from equilibrium. Even for the relatively simple model of the financial sector we have constructed, the dynamics of adjustment would be extremely difficult to obtain analytically. Althouth the system is nonlinear, one might expect the endogenous variables to exhibit behavior similar to that generated by a high order linear difference equation. Hence we should not be surprised to find that the speed with which particular variables adjust to their new equilibrium depends on the particular exogenous variable which is changed. Moreover, there is no simple way to infer from the speeds of adjustment to each of two or more individual shocks how fast the system would adjust to a combination of shocks, either simultaneous or sequential.

In our simulations (see Table A-4) it appears that most variables are relatively slow to reach a new equilibrium following an increase in the supply of real capital or an increase in the marginal product of capital, and adjust relatively fast to an injection of reserves. Similarly, on the basis of the analogy with linear difference equations, we would expect to find some variables responding relatively fast to some shocks and relatively slow to others. Demand deposits, for example, complete 75 percent of their adjustment to a change in income within two periods, whereas loans require 18 periods for a similar adjustment. In response to a change in the marginal product of capital, however, loans adjust 75 percent of the way in 5 periods whereas the similar adjustment requires 9 periods in the case of demand deposits.

In spite of the fact that relative speeds of adjustment depend on which exogenous variable is changing, some endogenous variables seem to adjust relatively slowly for almost all of the shocks we have considered. Even though individuals always hold the desired quantity of loans, L is frequently among the last of the variables to come within 25 percent

[2] For example, consider the following trivial model:

$$X_D^*(t) = B_0 - B_1 P(t)$$
$$\Delta X_D(t) = \alpha(X_D^*(t) - X_D(t-1))$$
$$\overline{X}_S(t) = X_D(t)$$

where X_D^* is the desired quantity of a commodity, P its price, ΔX_D the change in actual demand, $\alpha \neq 0$ the speed of adjustment, and $\overline{X}_S$ the exogenously determined supply. Irrespective of the speed of adjustment α, the system will be in long-run equilibrium two periods after a change in the supply.

TABLE A-3

EXTENDED MODEL CYCLES

Amplitudes (Peak less Trough) Relative to Amplitude of Driving Force
(10% of Equilibrium Value)

	Strong Investment Variant					Weak Investment Variant				
	Exogenous cycle in:									
	GP, Govt. Purchases		r, Marg. Product		Reserves R	GP, Govt. Purchases		r, Marg. Product		Reserves R
	r_S pegged	R fixed	r_S pegged	R fixed		r_S pegged	R fixed	r_S pegged	R fixed	
Demand deposits D	1.42	.83	1.31	1.16	.66	1.32	.79	1.08	1.03	.63
Time deposits T	.33	.52	.41	.25	.42	.34	.54	.40	.23	.41
Security holdings S^P	1.24	.94	.56	.79	1.73	1.20	.90	.53	.75	1.73
Loans $-L$	.38	.20	1.02	.95	.37	.28	.17	.91	.85	.34
Excess reserves* E	.10	.07	.09	.12	.09	.04	.06	.07	.11	.11
Banks' securities S^B	.83	.22	.61	1.09	.87	.90	.16	.61	.94	.90
Security rate r_S	.05	.39	.00	.20	.39	.05	.39	.00	.20	.39
Yield on capital r_K	.10	.16	.91	.93	.06	.03	.13	.76	.81	.12
Loan interest r_L	.14	.33	.70	.80	.21	.10	.29	.58	.70	.27
Equity value ρ	.00	.00	.20	.20	.00	.00	.00	.40	.40	.20
Reserves R	1.00	.00	.41	.00	1.00	.93	.00	.41	.00	1.00
Income Y	.80	.68	.34	.30	.12	.76	.26	.68	.24	.10

* Amplitude given in units.

Now, to explain the "given prices" in the markets and the kind and volume of transactions that actually come about, we need to know also the supply conditions. What does it cost to produce a market survey; to print a mass-circulation paper or a professional periodical; or to run a school? And to rear and train a vice-president or to build an automatic pilot? Again, the supply conditions are interrelated, although perhaps not as closely as the demand conditions. An automatic pilot combines the services of inquiring and of deciding, and it might be more costly to produce these services separately.

At any rate, the supply of a given service or a bundle of services—at given prices!—will depend on the costs of producing various kinds and amounts of them. Under competition the price will, then, equate demand and supply.

Is this not classroom economics? Yes indeed. But it should include the more advanced parts of it which allow for oligopoly, uncertainty, and other such things, mildly called "imperfections." Particularly important are the facts of indivisibility, or more precisely, the lack of homogeneity, of standardization of many of the symbol manipulators. There exist almost unique, irreplaceable research workers, teachers, administrators; just as there exist unique choice locations for plants and harbors. The problem of unique or imperfectly standardized goods is not peculiar to the economics of inquiring, communicating, and deciding. But it has been indeed neglected in the textbooks.

Let us return to the comparison of services supplied by men and by machines. The subject has seriously worried the most creatively imaginative pessimists of science fiction—from Karel Čapek to Ray Bradbury. It has also fascinated, and has led to some serious work of, psychologists and computer scientists. The results of this work, however tentative, are of great interest to us economists.

To begin with, humans are very poor transmission channels. "Indeed," says George Miller, a leading psycholinguist, "it is an act of charity to call a man a channel at all. Compared to telephone or television channels, man is better characterized as a bottleneck. Under optimal conditions it is possible for a skilled typist or piano player to transmit 25 bits per second. . . . We shall have to regard 25 bits per second as near the upper limit." More usually, the transmission capacity of an average person in our culture is only 10 bits or less, that is, we are unable to identify a stimulus without error when the stimulus is selected from more than 2^{10}, i.e., about a thousand equiprobable alternatives (that is, when the identification logically requires at least ten yes-or-no questions). As to the so-called "short memory," an important accessory of many transmission instruments, George Miller says that "no self-respecting photographic plate would even bother to sneer at us."

clothing and for food, consumers do find it advantageous to buy ready-made suits and standardized groceries. To go to a Bond Street tailor or to buy fancy foods is slightly more satisfactory but so much more expensive!

The problem is familiar to operations researchers as that of optimal assortment. It is also known to social and economic statisticians, editors of census volumes, and makers of production indices. They call it "optimal aggregation." What indeed is the most economical way to break down a collection of items into groups, each to be treated as if it were homogeneous, when every detail suppressed involves some sacrifice, yet also saves cost?

Thus, it is just possible that, for the purposes of large markets (but not, I would think, for the purpose of building a particular satellite!) the isolated theory of transmission channels that minimize the probability of error—any error—is exactly what one needs. Yet, to be sure of this, we ought to have at least an approximate idea as to whether the services immediately complementing the transmission, that is, the services of coding, also exhibit advantages of mass production; and that the imperfections of available data producing and decision-making services are indeed negligible as to their economic effects.

Inanimate transmission channels do display the advantages of mass production. This makes it useful, when studying their supply conditions, to apply the pure theory of communication and to derive economically significant results from measuring information in bits. But what about other symbol-manipulating services: inquiry, coding, deciding? What can we say, in particular, about those supplied not by machines but by humans?

Before commenting on this most fascinating question, let us remind ourselves of the principles of the analysis of demand, supply, and the markets, and apply them, in particular, to the markets of symbol-manipulating services.

The demands of individual users are aggregated into the total demands for various data-providing services: total demands for weather forecasters and market prophets; for the output of research laboratories, for services of spies and detectives—given the prices of each of these services. Similarly with the total demands for various communication services—television, telephones, post office, newspapers, but also schools! —given, again, the prices of each. And so also with the demand for deciders—inventory clerks and vice-presidents for finance, and humble robots. Some of these services are substitutes for one another: for example, TV, radio and newspapers; telephone and mail. Some are mutual complements: the demand for weather data and for radio sets boosts each other.

Moreover, depending on the user's result function, he may fear some errors of communication but be indifferent to others. He may be indifferent to the music of the voice at the other end of the telephone; so he does not really need a high-fidelity telephone.

On the other hand, statisticians have isolated their problem, also essentially an economic one, by omitting the communication components. As I said before, this may be a good research strategy. I am told that in the early space vehicles rectangular pieces of equipment were used although the vehicles had circular cross-section. That is, the problem of building a good battery (say) was solved separately from, not jointly with, the problem of building a fast vehicle. Our problem-solving (decision-making) capacity is limited to only a few good solutions per manhour. To take up all problems at once is desirable but not cheap and perhaps not feasible. However, as time goes on the joint approach should be tried. Hence this economist's appeal to both statisticians and engineers.

I have just said that the limitation of the research capacity of all of us explains and possibly justifies the fact that engineers and statisticians have broken up the economics of symbol manipulation into separate sections, neglecting the essential complementarity of the several services from the point of view of the demand by the user.

However, this separation seems to be partly justified also by the economics of the services themselves; viz., by the supply side. I mean in particular the conditions for the production, and therefore for the supply, of inanimate transmission channels, such as telephones, the broadcasting apparatus, perhaps even the products of the old-fashioned printing press.

To be sure, you may not be anxious to learn about the bridal dress and be very much interested in the stock market. Yet your morning newspaper will bring you both a society page (which you will throw away) and a stock market page. Any page costs as much to print as any other page. The cost depends on the number of symbols on the page, and this corresponds to the number of bits transmitted by the printed messages. And the cost per bit turns out to be smaller if every subscriber receives both the social page and the stock market report and the sports page and the political news, regardless of his special tastes. Similarly, I am forced to subscribe to a high-fidelity telephone service although I am not interested in the music of the other person's voice. I suppose this is due to the economies of mass production. It is cheaper to produce instruments that will minimize the probability of transmission error—any error, however unimportant to me personally—than to custom-make instruments which would suit people's individual preferences. Remember that, in this country at least, with its large total demand for

of output symbols given an input symbol); and on the coding and decoding procedures.

Clearly, an appropriately redundant code can almost overcome the lack of reliability of the channel; that is, it can almost eliminate the occurrence of errors. For example, the encoder just lets every "yes" or "no" to be repeated many times, and the decoder takes "no" for the answer if he has received more "no"'s than "yes"'s. "Don't!—repeat, don't!—repeat, don't shoot!" If I have heard two don'ts and only one do, I shan't shoot. However, we may need great redundancy of the code if the channel is very unreliable; and this will cause long delays if the channel is slow. But a channel that is fast and reliable is expensive.

If the user can afford to wait for a long sequence of data to flow in before they are encoded, the problem of choosing between channels is simplified, for their variety is reduced as follows. Instead of a whole array of likelihoods (of channel output symbols, given each input symbol) it becomes sufficient to use a single reliability measure (in bits per input symbol) which, multiplied by the channel's speed of transmission (in input symbols per time unit), gives the channel's "capacity," in bits per time unit.[2] Provided this capacity is larger than the number of bits per time unit that characterizes the uncertainty and speed of the flow of data, it has been shown that the user can achieve any desired probability of errors, however small, by using an appropriate, though redundant, code. Assuming that such codes have indeed been constructed (quite a difficult problem, solved only to a small part), it would be for the user to weigh against each other the disadvantages of errors, of time delays and of the high costs of high-capacity channels.

To avoid errors in our mutual understanding, let me be redundant, mindful of my low transmitting capacity and of your limited memory. I said a short time ago that engineers have isolated the pure communication problem by not concerning themselves with the services that produce data and that decide on acting; and also by usually refusing to distinguish between important and unimportant errors. I also pleaded, a longer time ago, on behalf of economists who emphasize that the demand for all services, all the transformers on my chart, is a joint one. Indeed, the user can improve the reliability of messages on which decisions are based by improving the communication service, but also by improving the data producing service which he is free to choose. Similarly, the user (the "meta-decider") is free to choose the deciding service; for example, he may prefer not to burden the unskilled but inexpensive decider with messages written in a vocabulary that is too rich and fine.

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[2] For example, two channels with equal transmission speeds and each characterized by the same array of likelihoods as, respectively, the old and the new barometer of our previous illustration have approximately equal capacities, in bits per second.

struct channels for the fast and reliable transmission of signals. (It all started in the telephone industry!) He is therefore also interested in devising appropriate codes which translate ordinary English into signals and signals back into English. But, to concentrate his mind on pure communication economics he makes, in effect, the following simplifying assumptions: First, events and data are identical, for he is not interested in the imperfections of the data producing service. Second, deciding is the same thing as decoding; so that action is simply the same thing as the message received. Third, as we have observed for the case of non-equiprobable events (which is, of course the usual case), the count of bits presupposes, in general, long sequences of events; and, as we shall see, such long sequences are also essential to make the crucial concept of "channel capacity" useful. Fourth, in most though not all[1] of their work, communication engineers assume an extremely simple result function. There are only two results: bad (say, minus one), when the decoded, received message is not identical with the datum sent; good (say, zero), when the two are identical. That is, all errors are equally important, have the same disutility, whether an inch is taken for a mile or merely a colon is taken for a semicolon. Finally, utility is assumed to be additive; i.e., it is conceived as the sum of certain measurable advantages and disadvantages, appropriately converted into dollars. We have seen that statisticians make the same assumption when they compare the sampling error with the dollar cost of the sample. The economist who detects and warns against this assumption is somewhat of a purist. The assumption is surely convenient for practical purposes and its removal is perhaps not that urgent.

Indeed this last assumption permits the engineer to ask the following economic question on behalf of the user of transmission channels and of coding services. Given the dollar costs of available channels, what is the best combination of the following evils: the probability of error (any error); the cost of the channel; the average time delay, which depends both on the length of signal sequences transmitted at a time and on the size of the code's vocabulary. That is, disutility is thought of, in effect, as a sum of dollars that buy a given channel; plus the dollar-equivalent of an error (any error); plus the dollar-equivalent, to a given user, of each time delay arising in the coding and transmission of a given datum. The user's problem is to choose that combination of channel and code which will minimize the sum of the averages of these amounts, weighted by appropriate probabilities. What do these probabilities depend on? On the uncertainty about data (=events); on the likelihood array characterizing the channel's reliability (the array of conditional probabilities

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[1] Not, in particular, in Claude E. Shannon's work on a "fidelity criterion," which does correspond to a general result function.

English word uncertainty: for when the odds are 9:1 I am almost certain, and with odds 1:1, I am fully ignorant, am I not?

Now suppose you have the choice between learning both the style and the color of the bride's dress and learning, with equal speed and for the same fee, the future price of your stocks. Suppose the price is as likely to rise as to fall. Depending on your selling or purchasing now, you may lose or double your fortune. A service that will tell you correctly whether the stock price will rise or fall conveys only one bit of information; whereas the service telling you correctly both the style and the color of the dress provides two bits. Yet you will prefer to learn about the stocks, not about the dress. There is, thus, no relation between the number of bits conveyed and the gross value of the data producing service. Nor does there seem to be a relation between the number of bits and the cost of a data producing service. For example, the cost of a sampling survey depends on its size, and this is not clearly related to the number of bits involved.

On the other hand, the number of yes-and-no symbols involved is clearly relevant to the performance and the cost of the transmission service regardless of whether these symbols refer to the length of the bridal skirt or to the trend of prices of your stock. To the economist, the contrast between production and transmission of data is strikingly analogous to the contrast between production and transportation of goods. A gallon of whiskey is more valuable than a gallon of gasoline: their costs to the producer and their values to the buyer are quite different. Yet to transport one gallon over one mile costs about the same for any liquid.

When, some twenty years ago, those elusive things labeled by the vague English words "uncertainty" and its negative, "information," were harnessed, subjected to genuine measurements (as was energy some hundred years ago, and mass and force much earlier), it was easy to understand the enthusiasm of people in elusive fields such as psychology. But also, to some extent, in statistics and in mathematics, where it was partly due to deep and beautiful theorems developed in this context. It is remarkable that C. Shannon who first proposed these theorems clearly limited their application to communications.

Statistical decision theory deals only with the choice of experiments and of decision rules; that is, with the choice of data producing and of deciding services. It omits the lower row of the chart reproduced above: encoding of data into signals, transmitting signals through a "communication channel," and decoding them back into messages that the decider would understand. In other words, for the statistician the decision is taken on the basis of a message which is simply the same thing as the data produced by the inquiry or experiment.

Not so with the communication engineer. His responsibility is to con-

TABLE A-4

FINANCIAL SECTOR MODEL

Speeds of Adjustment to Once-for-all 10% Increases in Single Variables (Smallest number of periods after which variable's distance from new equilibrium is 25% or less of full equilibrium response. Starred entries (*) designate adjustment paths that overshoot and oscillate.)

| Variable | Shock | Reserves R | Govt. Debt G | Real Cap. K | Preferences for Demand Deposit | | | | Marg. Prod. r | Income Y | Reserve Req. | |
					from T^{**}	from S^{***}	from K^{***}	from L^{**}			k_D	k_T
Demand deposits	D	5	5*	10*	2	3	2	2	9	2	4	5
Time deposits	T	7	14*	10*	6	7	6	5	7	6	8	8
Security holdings	S^P	4	1	12*	5	1*	8	8	10	8	4	4
Loans	$-L$	4	11	7*	13*	20*	11*	3	5	18**	10	9
Excess reserves	E	4*	5*	5*	5	2	4	5	7	5	4*	1
Banks' securities	S^B	5	4*	12*	6	6*	9	8	10	8*	5	4
Security rate	r_S	1	2*	2*	5	1	2	3	6	3	2	3
Yield on capital	r_K	3*	15*	10*	15*	2	5*	7	8	4	2	2
Loan interest	r_L	4	4*	9*	4*	4	5	5	7	5	4	3
Equity value	p	3*	15*	9*	15*	2	5*	7	6*	6	2	2

of its new equilibrium value. In two-thirds of the cases, the loan rate, which banks adjust "slowly," achieves 75 percent adjustment before the quantity of loans. With the exception of the adjustment to a change in the marginal product of capital, demand deposits adjust more rapidly than time deposits.

VII. *Cyclical Timing Patterns*

In a highly interdependent dynamic system, the chronological order in which variables reach cyclical peaks and troughs proves nothing whatever about directions of causation. Although few people would seriously claim that cyclical lead-lag patterns are a reliable guide to direction of causal influence, believers in the causal primacy of monetary variables have offered the timing order of variables in business cycles as partial evidence for their position. Simulation of cycles of known exogenous or causal source is a good way to show that observed timing order can be very misleading.

The dangers involved in relying on the timing of peaks and troughs as an indication of causality are illustrated in Tables A-5 and A-6. In every case considered, some endogenous variable leads the exogenous variable driving the system. In each of the reserve cycles, for example, free reserves lead the total supply of reserves. Similarly, an exogenous cycle in the marginal product of capital generates a cycle in income which leads it in both variants of the extended model.

Even though leads and lags do not provide information about

TABLE A-5

LAG (+) OR LEAD (−), COMPARED WITH EXOGENOUS CYCLES (24 PERIODS)
FINANCIAL SECTOR

Endogenous Variables	Exogenous Variables			
	Y	R	G	$Y, \Delta K$
D	½	2½	−2½	0
T	(2½)	3	(−2½)	(4)
S^P	(2)	(2)	½	(−5½)
$-L$	−1	5½	(−4½)	2
E	(0)	−1	(−2)	(0)
S^B	−4	3½	−1	−5½
r_S	1	(½)	−2½	3½
r_K	3	(2½)	(1)	2½
r_L	2½	(3)	−4½	4
p	(4)	2½	1	(2½)
R	—	0	—	—
Y	0	—	—	0
ΔK	—	—	—	0

Comparison is with second cyclical peak of cyclically fluctuating exogenous variable in simulation run. Numbers in parentheses refer to timing of a trough in comparison with this reference cycle's peak; this comparison is made for variables that move countercyclically.

TABLE A-6

LAG (+) OR LEAD (−), COMPARED WITH EXOGENOUS CYCLES (24 PERIODS)

	Extended Model—Strong Investment					Extended Model—Weak Investment				
	r_s pegged R endogenous		R-cycle	r_s endogenous R fixed		r_s pegged R endogenous		R-cycle	r_s endogenous R fixed	
	GP-cycle	r-cycle		GP-cycle	r-cycle	GP-cycle	r-cycle		GP-cycle	r-cycle
D	2	−1	1	1	−⅞	2	−⅞	1⅞	1	−2
T	(−1)	4⅞	3⅞	(2)	5⅞	(−⅞)	5	3⅞	(2⅞)	4
S^P	(+1)	(−1⅞)	(1⅞)	(−5⅞)	(−5⅞)	(1)	−1	(1⅞)	(−5⅞)	6 or (−6)
$-L$	2	1⅞	3⅞	−2	2	2⅞	2	4	−2⅞	⅞
E	0	(−2⅞)	−1	(0)	(0)	0	(−1⅞)	−1⅞	(⅞)	(−2)
S^D	3	(5⅞)	2	−3	−6 or (6)	3⅞	−6 or (6)	2	−1⅞	(4⅞)
r_s	—	—	(1)	1⅞	3	−4	—	(1)	1⅞	1
r_K	⅞	2	(−⅞)	1	2⅞	−3⅞	2	(⅞)	1	1
r_L	⅞	2	(1⅞)	2	3⅞	−1	3	(1)	2	2
P	—	−2	0	—	—	—	−2	⅞	—	−3
R	1⅞	1⅞	0	—	—	1⅞	1⅞	0	—	—
Y	⅞	−2	0	0	−1⅞	⅞	−1⅞	⅞	0	−3
ΔK	1	−2	0	0	−1⅞	3	−1⅞	⅞	—	−3

Comparison is with second cyclical peak of cyclically fluctuating exogenous variable in simulation run. Numbers in parentheses refer to timing of a trough in comparison with this cycle's peak; this comparison is made for variables that move countercyclically.

causation, if they could be depended on they would be extremely useful in forecasting the future course of the economy. Unfortunately, the tables provide numerous examples of variables which lead another endogenous variable when the economy is driven by one exogenous variable and lag it when driven by another exogenous variable.

For example, in the extended model with reserves fixed, loans lead income when government purchases are the driving force, but lag income in cycles driven by fluctuations in the marginal product of capital.

Similarly, in the financial sector simulations, the rate on securities leads the rate on equities by two periods when income alone varies exogenously, but lags it by one period when fluctuations in investment accompany the variations in income.

Not surprisingly, the leads and lags are also sensitive to the policy actions of the monetary authority. If the supply of reserves is fixed and government purchases cause fluctuations, free reserves trough when income peaks. When the monetary authority pegs the rate on securities, however, free reserves actually peak with income. Similarly, in the "strong investment" variant, loans lead government purchases by two periods when the rate on securities is endogenous and lag government purchases when it is pegged.

THE F.R.B.-M.I.T. ECONOMETRIC MODEL:
ITS SPECIAL FEATURES

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I. *Introduction*

This paper outlines the chief conceptual characteristics of an inter-mediate-sized (65–70 stochastic equations) aggregate quarterly model of the United States economy designed primarily for use in the planning of short- and intermediate-run (three years) economic policy.[1] The construction of yet another quarterly econometric model was under-taken with a specific purpose in mind. In our opinion, the existing models do not satisfactorily serve the needs of those charged with responsibility for stabilization policy, in the sense that they do not adequately in-corporate explicit policy instruments, such as Federal Reserve credit, the discount rate, reserve requirements, various federal tax rates, and other tax provisions. This led a group of economists to construct an en-tirely new model, a decision which provided them with an opportunity to incorporate a number of additional features. Among these are: (*a*) the explicit recognition of balance-sheet constraints in the household, com-mercial bank, and state and local government sectors; (*b*) an effort to specify more clearly the behavioral characteristics of the economic units participating in the residential housing market; (*c*) incorporation of recent developments in production and investment theory; (*d*) an effort to obtain a consistent framework for employment, investment, produc-tion, and pricing decisions; (*e*) a more careful and detailed treatment of the financial sector.

What we are presenting here is a rather detailed progress report, since the model is not yet in final form. It is fair to say, however, that most of the important conceptual decisions concerning the general structure of the markets which comprise the model have been made and are reflected in the version presented here. In formulating the individual equations that constitute the entire model, we have made every effort to reflect our theory of the behavior of the economic units involved. The estima-

tion procedures used, on the other hand, reflect only initial efforts. In general, heavy emphasis was placed on a rather detailed examination of the lag patterns involved, relying largely on the Almon-Lagrange inter-polation technique [1], but the parameter estimates were derived by ordinary least squares procedures with appropriate corrections where necessary for serial correlation of residuals. Presently, no attempt has been made to examine the properties of the system using consistent estimators.

As many of its predecessors, this model depicts the economy as an in-terrelated dynamic process involving the successive generation and re-generation of income, prices, wages, and aggregate demand and output. Furthermore, the actual specification of the model reflects the judg-ment that there have been very few if any periods of demand inflation (aggregate demand greater than the short-run productive capacity of the economy) in the United States since the Korean war. The structure of the model, therefore, centers around an explanation of the demand for constant dollar gross private domestic business product. Prices and wages are largely determined by lagged variables.

The model is also characterized by heavy emphasis on the role of the instruments of economic policy, particularly the instruments of mone-tary policy. In general the structure of the model implies that the full effect of monetary policies is felt immediately only in the short-term money market. Long-term bond yields, equity yields, and the cost of capital are affected only with a considerable lag and the full effect of these variables on aggregate demand involves an additional delay. However, the long-run effects of monetary policy seem to be quanti-tatively important. The duration of this transmission process suggests that the current level of aggregate demand is largely unaffected by cur-rent interest rates. The only major exception to this process seems to be the effects operating through the mortgage market on the demand for housing. Therefore, given aggregate demand, current interest rates are determined by the supply of Federal Reserve bank credit (currency plus unborrowed reserves), and by other monetary policy instruments.

The effects of fiscal policy on aggregate demand are felt through the influence of varying levels of government expenditure and taxation. Other provisions of the tax laws alter the net rent on producers' equip-ment and structures, thus affecting, with various lags, these two par-ticular components of demand. Debt management policy of the Trea-sury has no impact in this model since the relationship between interest rates on various maturities of debt is taken to be independent of the ma-turity composition of publicly-held federal debt.[2] This result may be due

[2] The model suggests differing monetary effects of a deficit, depending on whether (a) the entire deficit is financed by the sale of marketable debt to the public, (b) the entire deficit is financed by the sale of marketable debt, but some of this is absorbed by the Federal Reserve, or

to the absence of large changes in maturity compositions over the sample period.

Another important conceptual characteristic of the model is that household net worth should be treated as an endogenous variable, resulting from saving (National Income Accounts concept) plus capital gains. This procedure, of course, implies that an attempt must be made to explain the gross movements in the value of corporate equities, as well as the changing value of residential structures (capital gains on other consumer durables are assumed to be zero). This sector of the model, however, is not yet operational. In Sections II–VII, each of the individual sectors is discussed in detail, and relevant comparisons with other aggregate econometric models are noted. Section VIII presents the results of some preliminary simulation experiments.

II. *Demand for Final Output*

A. *Aggregate Consumption (CON) and Expenditures on Consumer Durables (EC)*. In dealing with consumer expenditures, the model systematically distinguishes between aggregate consumption as a flow of services, and expenditures on consumer durables. In this respect, the stock of consumer durables is treated in the same manner as OBE treats residential housing, with the associated flow of imputed services being added into aggregate consumption.[3]

The basic hypothesis regarding the level of aggregate consumption was originally drawn from the life-cycle models of Modigliani, Brumberg and Ando [4] [21] which specify consumption as a function of labor income, expected labor income, and net worth of households. The behavioral relationship determining aggregate consumption in the present model reflects two modifications of this scheme. First, additional arguments are specified in order to deal with the effects on aggregate consumption of a temporary disequilibrium in household holdings of consumer durables. That is, the attempt of consumers to restore portfolio balance with respect to their consumer durable assets will directly affect the consumption of services. Second, at the moment our model does not distinguish the separate influences of labor and property income. The present value of both future labor income and future property income (net worth of households) is measured by a distributed lag on total disposable income (YD). This model is specified as follows:

(c) part of the deficit is financed by drawing down Treasury cash balances at member banks. The distribution of public debt among various economic units outside the Treasury and Federal Reserve System, however, has no influence in this system.

[3] Consistent with this treatment of consumer durables, gross output (X) in the model is defined somewhat differently than in the National Income Accounts (*OBE*). It is related to the OBE concept (*XOBE*) as follows: $X = XOBE +$ imputed flow of services on household stocks of consumer durables, where the imputed flow of services is equivalent to the loss in value of the stock during the period plus the opportunity cost of the capital invested.

$$(1) \qquad CON = \sum_{i=0}^{10} \beta_i YD_{t-i} + \theta(KC^* - KC_{t-1}) \qquad \theta > 0$$

where:

$$(2) \qquad KC^* = \gamma_1 YD + \gamma_2 R + \gamma_3 CON$$

CON = aggregate consumption
YD = disposable income = disposable income OBE (current $) de-
        flated by the implicit price deflator for CON plus YC
R = relative rental rate of durable goods = $(PC/PCON)$
     $\cdot(UWC+RCB)$
PC = implicit price deflator for consumer durable expenditures
RCB = long-term corporate bond rate
UWC = depreciation rate for consumer durables
$PCON$ = implicit price deflator for consumer services
YC = imputed rental income on consumer durables.

In the long run, consumer asset portfolios can be assumed to have achieved equilibrium; i.e., $KC_t^* = KC_{t-1}$. Thus, in equilibrium, we retain the conventional life-cycle hypothesis of saving. The following estimates were obtained from quarterly data for the period 1953–65.

$$\frac{CON}{YD} = .3531 + .28\left[\frac{KC_{t-1}}{YD}\right] + .0419R + \sum_{i=1}^{10} \beta_i\left[\frac{YD_{t-1}}{YD}\right]$$

(3)

$$SEE = .0036 \qquad \hat{\rho} = .842^4 \qquad \sum_{i=1}^{10} \beta_i = .4290$$

The estimated lag structure (the β_i's) revealed a sharply declining series of positive weights with a long-run marginal propensity to consume services of .78. Investment in consumer durables (other than houses) results from a stock-flow adjustment model, with the equilibrium stock specified by equation (2) above.

Comparison of our estimates of the "one-period" marginal propensity to consume durables with those of the Wharton [9] and OBE [16] models reveals that our model contains a much higher propensity to consume, which is in turn "offset" by a much faster speed of adjustment. Further tests of the model, considering the system as a whole, may indicate that this property is unsatisfactory and necessitate further work on this specification.

In the case of aggregate consumption and expenditures on consumer durables, monetary (interest rate) effects are transmitted to aggregate

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[4] In order to remove the effect of the high serial correlation in the residuals from our estimates, the above model was estimated under a first-order autoregressive transformation of the variables. ρ is the autoregressive coefficient that yielded a minimum for the transformed residual sum of squares.

demand in the present model only through the effect of interest rates on the rental price of durable goods. Preliminary work has indicated, however, that in an expanded and more detailed version of this mechanism (with total income separated into its two components: labor and property income), we can expect to isolate important interest rate effects on the valuation of household net worth. No systematic tests have yet been performed to ascertain what effects, if any, imperfections in the consumer credit markets have on expenditures for consumer durables. Government expenditure and taxation policies, of course, have a major effect on consumption expenditures through their effects on disposable income.

B. *Residential Construction Activity.*[5] The model of residential construction activity centers around the determination of three basic variables: the rental cost of housing services, the price per unit of the stock of houses, and the volume of new housing starts. The rental cost of housing services is determined by the relationship between the demand variables, income and the number of households, and the available supply of housing services represented by the existing stock of houses. In order to allow for a lag in the adjustment of rents to their equilibrium value, the percentage change in rents in a given period is assumed to be proportional to the difference between equilibrium and initial values.

Rents, appropriately adjusted for depreciation and taxes, together with the expected rate of change in the price of houses and the required rate of return on houses (measured by the rate of return on alternative assets expressed as a linear combination of the corporate bond rate, the dividend/price ratio, and the mortgage rate) determine the equilibrium price of houses. The actual price offered by purchasers of housing assets is assumed to adjust gradually to this equilibrium price. The supply of houses (housing starts in dollar terms) is then determined by the relationship between the price of houses (current and lagged), construction costs, and interest rates on mortgages.

In the current version of the model, the mortgage rate represents the only mechanism through which the "availability" of mortgage funds affects housing starts. Further work is under way to investigate the possibility that the mortgage rate does not adequately reflect the effect of credit conditions on housing starts. The above relationships determine the level of rents, the price, and the increase in the stock of houses. In the present version of the model, the asset demand for houses and the supply of residential structures are collapsed into a single equation relating the value of housing starts to rents, mortgage rates, construction costs, and the cost of capital for residential houses. In relation to other

[5] The formulation of this section is the work of Gordon R. Sparks. This discussion deals only with the determination of housing expenditures, given interest rates. The influence of the mortgage market will be discussed in more detail below.

models [18] [19] the above structure places much heavier emphasis on the price of houses and rents as market clearing mechanisms. Variables such as vacancies, removals, and inventory under construction could be relevant arguments in this type of structure if prices and rents do not adjust sufficiently quickly. The instruments of economic policy affect this market through their effects on disposable income, rates of return, and on the cost and availability of mortgage funds.

The value of construction put in place ($EH\$$) is related to current and lagged housing starts using an equation which is consistent with the techniques used by the Department of Commerce in estimating these data.

C. *Expenditures on Producers' Durable Equipment (EPD) and Non-residential Construction.*[6] The relationships determining business fixed investment are generated by an extension of the neoclassical model of investment behavior first developed by Jorgenson [14] and Jorgenson and Hall [12]. The model is extended in two directions. First, the Cobb-Douglas production function as used by Jorgenson is replaced by a CES production function. Second, in keeping with the "putty-clay" version of the neoclassical model, allowance is made for the possibility of different reaction patterns to changes in relative prices (actual or expected) on the one hand, and to changes in output (actual and expected) on the other. The critical implication of a model where factor proportions are variable only before capital is put in place is that the short-run elasticity of investment expenditures, with respect to once-and-for-all changes in quasi-rents, is unlikely to exceed the long-run elasticity.

In the case of producers' durable equipment, the theory implies that new orders are a function of relative prices and desired gross additions to capacity with a complex distributed lag. The expression estimated is given by:[7]

$$(4) \qquad OPD_t = \sum_{k=1}^{17} \beta_{k,k-1} V_{t-k} XB_{t-k+1} + \sum_{k=1}^{17} \beta_{k,k} V_{t-k} XB_{t-k} + \epsilon$$

The relative price term, V_t, is defined as

$$(5) \qquad V_t = \alpha \left[\frac{PXB_t}{RTPD_t} \right]^\sigma$$

where α is a function of the parameters of the production function and σ is the price elasticity of the demand for producers' equipment. The denominator in the above fraction is the expression for the quasi-rent, and can be rewritten in the following manner:

[6] This sector of the model rests on the work of C. W. Bischoff.
[7] The derivation of and the additional restrictions necessary to arrive at this expression can be found in Bischoff [5].

$$(6)\ \ RTPD = \left[\frac{PPD(RPD + UWPD)(1 - (UTC)(VWPD) - TCPD)}{(1 - UTC)}\right]$$

where:

PPD = price of producers' durable equipment

RPD = cost of capital for producers' durable equipment

UTC = corporate tax rate

$VWPD$ = present value of the depreciation deduction per \$1.00 investment in producers' durable equipment for corporate income tax

$TCPD$ = effective rate of tax credit on investment in producers' durable equipment.

The cost of capital is determined from the following relation:

$$(7)\qquad RPD = (\gamma_0 + \gamma_1 RCB + \gamma_2 RDPG)(1 - UTC)$$

where $RDPG$ is the dividend/price ratio of common stocks.

Investment expenditures are related to new orders with a distributed lag whose pattern depends on the ratio of unfilled orders ($OUME$) to shipments (SME).[8]

$$(8)\qquad EPD_t = \sum_{k=0}^{5} (\beta_k + \gamma_k(OUME_{t-k}/SME_{t-k}))OPD_{t-k+1}$$

The coefficients appearing in equations (5), (6) and (8) were estimated by nonlinear maximum likelihood techniques applied to equation (5). The statistical properties of the estimates appear to out-perform competing models in terms of the standard tests, such as goodness-of-fit and serial correlation of the residuals.

As Bischoff reports, the estimated lag patterns for the above equation (5) strongly supports the hypothesis that relative prices affect equipment spending with a considerably different lag than do changes in output. While this result is in agreement with the "putty-clay" hypothesis, it is not inconsistent with some alternative theories.

The relationship explaining nonresidential construction was derived in a similar fashion to that for producers' durable equipment. In a preliminary version, the estimated lag patterns for the relative price term and the output term were so similar that, to improve the efficiency of the estimates, they were constrained to be the same. The actual equation estimated was

$$(9)\qquad EPS_t = \sum_{i=1}^{16} \beta_i V_{t-i} XB_{t-i} + \gamma KPS_t + u_t$$

[8] This relation is discussed in detail in Bischoff [5] and in Tinsley [30]. Shipments and unfilled orders are also endogenous variables in the model. For further details, see [5].

where

(10) $KPS_t = KPS_{t-1}(1 - UWPS/4) + EPS_{t/4}$

EPS = nonresidential construction
KPS = stock of nonresidential structures
$UWPS$ = asymptotic rate of decay of nonresidential structures.

In this case, of course, the V_i's reflect the quasi-rents and relative prices of nonresidential structures. The estimates of the coefficients of equation (10) are somewhat less satisfactory than those of equation (5). The above results indicate that the argument for a "putty-clay" production function is weaker for structures than for equipment.

Changes in corporate tax rates, depreciation rates, depreciation allowances, the investment tax credit, and monetary policy (through the cost of capital) are transmitted to business fixed investment expenditures through fluctuations in quasi-rents. The estimated coefficients, again reported in Bischoff [5], indicate that these effects are appreciable.[9]

This investment sector contains some striking contrasts to alternative models. First, disaggregation of investment behavior follows somewhat different lines than the present versions of the Wharton [9] or the Brookings [10] models. Whereas we have followed disaggregation by types of investment (equipment versus structures), they have followed disaggregation by industrial classifications. Second, as with investment in residential construction, prices and rents are the chief clearing mechanisms; unlike the Wharton [9] and Michigan [30] models, variables such as cash flow play no direct role. In addition, as noted above, this model accommodates the effects of tax regulations and relative prices on desired capital intensity of capacity through the particular formulation of quasi-rents.[10]

D. *Inventory Investment.* The model contains a single equation representing the demand for nonfarm business inventories. The underlying hypothesis postulates a stock adjustment mechanism to a desired inventory/sales ratio. The desired ratio is a function of current and lagged sales and new orders. In specifying the actual regression equation, sales were disaggregated into several major parts and provision was made to account for the effects of major labor stoppages on the accumulation of inventories. The regression equation that was estimated can be written as follows:

(11) $\Delta I_t = \alpha_1 \Delta ECO_t + \alpha_2 \Delta ECO_{t-1} + \beta \Delta EGPD_{t+1} + \gamma \Delta NDI_t$

$$+ \sum_{i=0}^{5} \theta_i OPD_{t-i} + \phi \Delta I_{t-1}$$

[9] [6, Table VII, p. 44].
[10] For further detailed comparisons of this model with alternative models of investment behavior, see [5] [6].

where

I = stock of nonfarm inventories

ECO = consumer expenditures (OBE)

$EGPD$ = defense procurement expenditures

OPD = new orders for producers' durable equipment

NDI = number of manhours idle due to major strikes.

Sales, orders, and lagged inventory variables show up significantly and with the expected signs. The estimated speed of adjustment coefficient is about 0.6. The coefficient of ΔECO_t, α_1, is roughly $-.14$, and should be interpreted as reflecting a sudden sales increase drawing down inventories. The much larger positive coefficient of ΔECO_{t-1}, ($\alpha_2 = .57$), represents the gradual buildup of inventories in response to the higher sales. Although attempts were made to isolate the influence of cost variables such as interest rate and rates of change of prices on inventory accumulation, we were unable to record any significant effect of these variables on the accumulation of inventories. Movements in farm inventories are taken as exogenous to the model.

E. *Balance of Trade.* At present, the model contains a highly aggregative and simplified mechanism determining U.S. exports and imports of goods and services. The constant dollar value of exports is simply taken as exogenous to the model. Imports are represented by a single equation (estimated in log-linear form). The hypothesis underlying this relation specifies the ratio of imports (EIM) to gross national product as a stable function of gross national product (reflecting the fact that the income elasticity of demand is not likely to be unity), relative price movements in the U.S. and abroad, and the rate of capacity utilization (reflecting the effect of demand pressures as output approaches capacity). The actual regression equation excludes the relative price terms[11] and includes two dummy variables that account for the effect of a major steel strike and a dock strike on the value of imports. The present version of the model makes no allowances for the possible effects of foreign interest rates on domestic economic activity.

F. *Government Expenditures.* Although the model takes federal government expenditures as exogenous, it does contain a unique and elaborate mechanism for the determination of expenditures (and revenues) of state and local governments.[12] The model begins from the notion that state and local expenditures and revenues are ultimately determined by the needs of the community and its ability and willingness to pay. However, these units are generally required to balance their current operating budgets and must pay a substantial risk premium for

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[11] Work currently being carried out by William Branson along homogeneous commodity lines identifies a significant role for relative prices.

[12] This aspect of the model relies on the work of Edward M. Gramlich [11].

frequent access to the capital markets. The model developed reflects the hypothesis that expenditure and revenue policies are formulated simultaneously, with the community's desire for private consumption, federal grants-in-aid, interest costs, and the statutory restrictions against borrowing for current expenditures acting as constraints in the decision process.

In general, the equations of the model explain expenditures very well. The response of construction outlays to income and interest rates is somewhat slower than that of other categories of expenditure. However, the reaction of all types of outlays to grants-in-aid is very rapid. In addition, our estimates indicate that fluctuations in the bond rate will have significant effects on state spending (especially on construction outlays). This is reinforced by the feedback effects between expenditures and revenues via the budget constraint.

IV. *Employment, Hours, Wages, and Prices*

A. *Demand for Labor.* The "putty-clay" CES aggregate long-run production function (from which the investment functions in Section III-C above are derived) implies that at every point in time there exists a stock of capital of various vintages and for each vintage, the output/labor ratio is fixed. It is further assumed that the capital stock will be utilized in order of decreasing productivity until aggregate demand is satisfied. Thus, there exists a unique relation between output and the manhours required for its production at any point in time—the short-run production function.

In general, this relation would be quite complex. To obtain an operational relation, we have assumed exponential rates of growth for both the capital stock and technological progress (Harrod neutral). Under these assumptions, the short-run production function implies a demand function for total manhours which contains output, productivity, and capacity variables as arguments. The following are the estimated parameters of such a function:

$$\ln (LMH) = \ln (XBC) - .0040 \, JR1 - .0041 \, JR2 - .0063 \, JR3$$

$$- .0067 \, JR4 + .6860 \left[\frac{XB}{XBC} \right]$$

(12)
$$- .1720 \ln (XB/XB_{-1}) - .0244 \ln \left[\frac{LF - LE}{LF} \right]$$

$$- 2.1066$$

$$SEE = .0035 \qquad \rho = .58$$

where:

$$LMH = \text{manhours worked (private domestic business sector)}$$
$$JR1, JR2, JR3, JR4 = \text{"productivity" time trends}$$
$$LF = \text{total civilian labor force}$$
$$LE = \text{aggregate civilian employment.}$$

Next, a relationship explaining hours worked per man per year is formulated in order to derive actual employment, given the level of total manhours worked. The hypothesis is that an increase in the cyclical demand for labor services will show up first as an increase in average hours and later in employment.[13]

B. *Supply of Labor.* Conceptually the supply of labor is defined by an equation relating the labor force participation rate to the composition of the population, the degree of difficulty in obtaining work as represented by the level of employment, the earnings of the principal worker in a family, and the potential earnings of secondary workers.[14] Pending the complete availability of the necessary data (consistent with the new definitions of labor force and employment) to incorporate these ideas, the following approximation has been adopted for the model:

$$\left[\frac{LF + LA}{N16} \right] = .3437 \left[\frac{LE + LA}{N16} \right] + .2388 \ln(t + 38.0)$$

(13)
$$+ .1544 \left[\frac{1000.0}{t + 200.0} \right] - 1.4157 \sum_{i=1}^{6} \beta_i \left[\frac{LE + LA}{N16} \right]_{t-i}$$

$$SEE = .0026 \qquad \sum \beta_i = .182$$

$LF = $ civilian labor force
$LE = $ civilian employment
$LA = $ armed forces
$N16 = $ population over age 16
  • $t = 1$ in 47:1, 76 in 65:4.

In this temporary equation, the employment of an additional 100 workers will bring 52 workers into the labor force over a period of $1\frac{1}{2}$ years.

C. *Wage and Price Determination.* The equation explaining the compensation rate is a modification of the formulation developed during the past decade by such authors as Phillips [29], Perry [27], Kuh [15], Eckstein [8], Phelps [26] and Simler and Tella [31]. This reflects our

[13] In addition, employment may be adjusted for more "permanent" changes in the demand for labor services, such as those associated with the expected rate of growth of the economy.
[14] See Simler and Tella [31].

tentative view that during the period 1952–65, excess demand with accompanying strong interaction between current prices and current wages was never the dominant force determining prices and wages. The estimated equation used in the model is of the form:

$$(14) \left[\frac{PL - PL_{-4}}{PL_{-4}}\right] = \beta_0 + \beta_1 \left[\frac{PCO_{-1} - PCO_{-5}}{PCO_{-5}}\right] + \beta_2 \sum_{i=0}^{3}\left[\frac{1}{ULUA}\right]_{t-i}$$
$$+ \beta_3 \sum_{i=0}^{3}\left[\frac{YPCT\$}{XB\$}\right]_{t-i} + \theta\left[\frac{PL_{-1} - PL_{-4}}{PL_{-4}}\right]$$

where

PL = the compensation rate
PCO = implicit price deflator for personal consumption expenditures
$ULUA$ = rate of unemployment adjusted for full employment labor force participation
$YPCT\$$ = corporate profits after corporate profits taxes, current dollars
$XB\$$ = gross private domestic business output, current dollars.

Our work on both the aggregate price level and relative price structure is still at a very preliminary level. The basic hypothesis on price formation during the period 1953–65 considers "desired" prices as a markup on unit labor costs and costs of raw material inputs, with the markup itself a function of the rate of capacity utilization. Actual prices approach "desired" prices with a distributed lag. Bischoff's estimate of the elasticity of substitution between labor and capital is close to unity, providing some basis for this markup hypothesis.

V. *Corporate Profits and Dividends*

In this model, corporate profits are required since they enter the equations explaining dividends and the corporate profits tax liability. Dividends, in turn, are needed to generate personal income. Gross business profits (including corporate profits and profits of unincorporated enterprises) are determined in this model as a residual. Corporate profits are then related to total business profits and the rate of capacity utilization. Corporate depreciation allowances are determined as a function of current dollar depreciation on the stock of plant and equipment and the rate of capacity utilization. Therefore the rate of capacity utilization is assumed to affect the distribution of profits both net and gross of depreciation between corporate and unincorporated forms of organization.

The relationship explaining corporate dividend behavior is a simple extension of Lintner's original model [17]. Two modifications have been made. First, dividends are allowed to adjust to their desired level in a

more flexible manner; second, desired dividends depend primarily on after-tax profits gross of depreciation rather than on net after-tax profits. The following parameter estimates were obtained:

$$(15) \qquad YDV\$ = .1717 + \sum_{i=0}^{7} \beta_i (YPCT\$ + WCO\$)_{t-i}$$

$$\sum_{i=0}^{7} \beta_i = .2659 \qquad \rho = .72 \qquad SEE = .203$$

where

  $YDV\$ =$ corporate dividend payments, current dollars
  $YPCT\$ =$ corporate profits after taxes, current dollars
  $WCO\$ =$ corporate capital consumption allowances, current dollars.

Some experimentation was conducted on the sensitivity of this relationship to changes in the cost of capital and the changes in federal tax treatment of corporate income versus personal income and capital gains, but no significant effects of these variables on dividend policy were uncovered.

VI. *Taxes and Transfers*

Here, as elsewhere in the model, we have made every effort to introduce explicitly the instruments of economic policy. We introduce explicitly various tax rates and benefits rates, and legislative provisions which define the tax base and/or benefit eligibility. In the case of federal taxes and transfers, we have adopted a modified version of the equations developed in Ando-Goldfeld [3] and Ando-Brown [2].[15] This formulation contrasts with, for example, that of the Wharton [9] and OBE [16] models in which the levels of taxes and transfers are simple functions of various measures of income.

In the case of state and local governments, the formulation adopted is that of Gramlich [11] in which tax rates themselves are not conceived of as explicit policy instruments; rather, tax rates are assumed to be adjusted in order to finance the desired level of expenditure subject to the willingness and ability of the communities to pay for these expenditures.

VII. *Financial Sector*

The purpose of this sector is to explain those financial variables that affect various components of aggregate demand and/or supply. (The effects on the supply side are rather indirect, operating primarily through changes in the capital/output ratio.) The demand equations discussed

[15] In the current Michigan model [30], this type of formulation has also been adopted.

in the previous sections imply that economic activity is sensitive to fluctuations in various market rates of return.[16] Long-term interest rates, equity yields, and the mortgage rate affect, in various combinations, most components of aggregate demand. These effects are particularly strong on investment in producers' durable equipment and residential structures. Needless to say, the model does not attempt a full explanation of the changes in equity yields, but simply tries to isolate that component of their variation which is systematically affected by variations in interest rates, and therefore by monetary policy. Since equity yields are measured by the dividend/price ratio, equity yields together with the equation determining dividends explain the value of corporate shares.

Short-term interest rates are determined in the money markets, and it is here that the instruments of monetary policy have their direct impacts. The key instruments of monetary policy which can intervene in the money markets are unborrowed reserves, the discount rate, and reserve requirements which operate through the money supply function, and perhaps Regulation Q interest rate ceilings which operate through the market for time deposits. The long-term interest rate is determined by the term structure relationship.

A. *Cost of Capital.* In this model, the costs of capital are defined to be linear combinations of the dividend/price ratio and various long-term interest rates. The parameters of these linear combinations are estimated directly in the demand equations.[17] In the following sections, we will discuss determination of equity yields and interest rates.

B. *Equity Yields.* The price of corporate shares is derived from a combination of two relationships: one explaining dividends (see Section V above) and another determining the dividend/price ratio (the yields on corporate equities).[18] Following a basic model set out by Modigliani and Miller [20] [22], a relationship is derived which specifies "equity yields" as a linear combination of expected long-term interest rates, expected changes in the overall price level, expected rate of growth of dividends per share, and a risk premium. For purposes of this model, we are most concerned with the relation between the dependent variable and interest rates. Therefore, as an initial trial, we treat the risk premium as part of the stochastic error term and approximate distributed lags on past changes in the respective variables.

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[16] In the final model we expect consumer expenditures to depend on household net worth. The chief cause of fluctuations in the value of net worth, aside from current saving, is variations in the prices of residential housing (see Section II-B above) and of corporate shares.

[17] The exception to this rule is the case of residential structures, where we have not carried out the necessary nonlinear estimation.

[18] The dividend/price ratio is defined as the ratio of national account dividends to the flow-of-funds estimate of the value of corporate shares.

However, we failed to isolate any significant role for expected changes in commodity prices, and the best estimates obtained were:

$$(16) \quad RDPG = \sum_{i=0}^{7} \beta_i RCB_{t-i} + \sum_{j=4}^{14} \gamma_j \left[\frac{\Delta YDV\$}{YDV\$} \right]_{t-j}; \sum_{i=0}^{7} \beta_i = .7709$$

$$SEE = .23; \qquad \sum_{j=4}^{14} \gamma_j = -.0174$$

$$\rho = .89$$

where

$RDPG$ = dividend/price ratio

$YDV\$$ = national accounts dividends.

C. *Money Market and Interest Rate Determination.*

1. Determination of the short-term interest rate.

In our model, short-term interest rates are determined by the interaction of (*a*) the demand equations for demand deposits and for currency by the public; (*b*) demand for earning assets and the consequent supply of demand deposits by commercial banks; and (*c*) federal government cash balances. This interaction is modified by the central bank through its policy variables affecting the commercial banking sector. In addition, commercial bank behavior with respect to the supply of demand deposits is significantly affected by commercial loans outstanding, and it is therefore necessary to deal with demand and supply for commercial loans in order to complete the model.

In our model, the long-run demand for money (currency plus demand deposits) is directly related to the flow of transactions, the transactions costs involved in exchanging money for short-term assets, and the opportunity cost of holding money. Therefore, assuming no significant variation in transactions costs, the equilibrium ratio of money demand to transactions is related to the interest obtainable on short-term assets. The difference between the actual demand for money and its equilibrium level is gradually eliminated with a speed of γ per unit time. In view of the multiplicative nature of the model, we have found it useful to express the above hypothesis in logarithms as follows:

$$(17) \quad \ln (MC\$ + MD\$) = \gamma k^*(i) + \gamma \ln XOBE$$
$$+ (1 - \gamma) \ln (MC\$ + MD\$)_{t-1}$$

where

$MC\$$ = currency outside of banks

$MD\$$ = demand deposits adjusted.

This equation can be directly estimated once we specify the functional

form and arguments in $k^*(i)$. We have applied the basic hypothesis above separately to the demand for demand deposits and the demand for currency, with somewhat different specifications of the arguments in $k^*(i)$ (in both cases log-linear functions of interest rates) and of the relevant transactions variable. Converting the model so that the dependent variable is velocity and substituting recursively for the lagged dependent variable, we obtained the following estimated equations:

(18) $\ln MD\$ - \ln XOBE\$ = -.1019 - .021 \ln RCP - .024 \ln RTD$

$$- .90 (\ln MD\$_{t-1} - \ln XOBE\$)$$

$$SEE = .004 \qquad \rho = .53$$

(19) $\ln MC\$ - \ln ECO\$ = .425 - .046 \ln RTD$

$$+ .80 (\ln MC\$_{t-1} - \ln ECO\$)$$

$$SEE = .0035 \qquad \rho = .88$$

$RCP =$ 4–6 month prime commercial paper rate
$RTD =$ rate on passbook savings deposits at commercial banks.

These results seem quite satisfactory and sensible. The estimated speeds of adjustment are 0.1 and 0.2 per quarter for demand deposits and currency, respectively. The short-run interest rate elasticity of demand for demand deposits (with respect to RCP) is moderate though significant. The long-run elasticity of demand deposits with respect to either RCP or RTD is just over 0.2 and thus it is .45 if both rates change together.

Both these equations were expanded to investigate the possible influence of a real income or wealth effect, the effect of interest expectations, and to allow for a more complex lag structure. Our work in this area is still in a preliminary stage [23].

The total money supply in the model consists of the sum of currency and demand deposits. The supply of currency in our framework is entirely controlled by the demand for currency. We consider the supply of demand deposits by commercial banks to be the consequence of their demand for earning assets. Our model can be set out as follows:

(20) $MFR\$^* = (a_0 - a_1 RTB + a_2 ZRDA) \cdot MDS\$$

(21) $\Delta EA^* = \gamma (MFR\$_{t-1} - MFR\$^*) \cdot (1/d)$

where

$MFR\$ =$ free reserves
$EA =$ earning assets
$d =$ reserve requirement
$RTB =$ Treasury bill rate

$ZRDA =$ discount rate

$MDS\$ =$ net demand deposits at member banks

$\Delta EA =$ desired change in earning assets in the absence of outside forces affecting reserves.

$MFR\$^*$ represents the level of free reserves desired by member banks. Equation (21) expresses the hypothesis that the change in earning assets, for an individual bank, is proportional to the difference between actual and desired free reserves. For the system as a whole this quantity must be adjusted for the level of reserve requirements. This change in earning assets, ΔEA^*, represents the amount by which banks would adjust their portfolio if their reserve position were not disturbed from outside. Such disturbances can result from changes in unborrowed reserves, changes in reserve requirements, and changes in time and savings deposits. Furthermore, we view the short-run variation in commercial loans as reflecting changes in the demand for these loans.[19] Banks react to the variation in these loans partially through adjustment of their reserve position. When equation (21) is modified to reflect these forces, the following equation for the actual change in earning assets (ΔEA) is obtained:

$$(22) \qquad \Delta EA = (a_0 + a_1 RTB - a_2 RD) \left[\frac{MDS\$_{t-1}}{d} \right]$$

$$+ \gamma_1 \left[\frac{MFR\$_{t-1}}{d} \right] + \gamma_2 \left[\frac{(1-d)\Delta MRU\$}{d} \right]$$

$$+ \gamma_3 \left[\frac{d-T}{d} \right] \Delta MTM\$ + \gamma_4 \Delta(d, T)$$

$$+ \gamma_5 JLR\Delta(d, T) + \beta \Delta DCLM\$$$

where

$MRU\$ =$ unborrowed reserves

$T =$ reserve requirement for time deposits

$MTM\$ =$ time deposits at member banks

$JLR\,\Delta(d, T) =$ variable reflecting timing of change in reserve requirements

$\Delta(d,\ T) =$ variable reflecting effects of a change in reserve requirements

$DCLM\$ =$ commercial and industrial loans at member banks

$\Delta EA =$ change in earning assets.

[19] Although not discussed here, the market for commercial loans consists of two equations. The loan supply equation which specifies the commercial loan rate as the dependent variable. This reflects the assumption that banks set this rate and then meet reasonable demands at this rate. The explanatory variables are bank portfolio variables and interest rates expressing the opportunity cost of granting loans. The demand equation for loans contains variables reflecting the level of various types of business activity and the relevant cost of raising funds. See [13].

Our estimates of the parameters of the above equation were highly satisfactory in most respects. The standard error of estimate was low (.673) and the estimated coefficients highly significant. The estimated speeds of adjustment are generally quite high—as high as .85 per quarter for the more predictable items such as the change in time deposits, and about .6 for the less predictable shocks such as changes in unborrowed reserves.

Since our model uses the commercial paper rate (RCP) as the short-term interest rate in the money demand equation and the Treasury bill rate as the short-term rate in the money supply equation, the model also contains a function relating these two rates. This function relates the commercial paper rate to current and lagged values of the Treasury bill rate.

2. Determination of the long-term interest rate.

The relationship determining the long-term rate (RCB) is built on the term structure hypothesis developed by Modigliani and Sutch [24].[20] The estimated equation is of the form:

$$(23) \qquad RCB = \alpha_1 RCP + \alpha_2 \sum_{i=1}^{n} W_i RCP_{t-i} + \alpha.$$

The estimated coefficients in this equation imply that in equilibrium the long-term rate is somewhat higher than the short-term rate, a phenomenon which cannot be accounted for by a pure expectations hypothesis. A possible explanation of this may be based on the time preference and behavior towards risk of borrowers and lenders. Further exploration by Modigliani and Sutch to detect the influence of the maturity composition of the federal debt on the rate structure has not been very successful. This model is found to explain the long-term rate remarkably well during most of the postwar period, but has tended to make larger errors in recent quarters.

3. Certificates of deposit.

We recognize the important role that certificates of deposit have had in financial markets since 1962. In several places, we have dealt with the appearance of a market for this instrument by using dummy variables.[21] In addition, we have attempted to formulate equations explaining the volume of CD's and the rate paid on them.[22] However, in view of the short sample period, the results are not very reliable.

D. *Financial Intermediaries*.[23] It is generally believed that the strong-

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[20] For further references, see Modigliani and Sutch [24].

[21] In particular, such dummy variables appear in the relation between the Treasury bill and commercial paper rates, and in the equation determining the commercial loan rate.

[22] The series used consists of non-passbook time deposits of individuals, partnerships, and corporations at member banks. In dollar terms, large CD's dominate the series.

[23] The estimation of the equations describing financial intermediaries and the mortgage mar-

est impacts of monetary policy actions are felt in the housing ,sector through the mortgage market. Because of various institutional arrangements in this latter market, including the existence of FNMA, VA, and FHA guarantee programs, and savings institutions specializing in mortgages, it is possible that the mortgage rate cannot be explained by the standard term structure equation, and that the flow of funds into the mortgage market directly influences the volume of housing starts. Once we admit this possibility, we must consider the determinants of the supply of and the demand for mortgages.

The supply of mortgages is largely determined by the flow of "savings type" deposits through financial intermediaries.[24] We have investigated the markets for commercial bank passbook savings, savings and loan association shares, and mutual savings bank deposits. On the supply side, our basic hypothesis is that savings institutions set the rate of interest payable on their deposit liabilities and then meet any reasonable demand for these deposits. The savings deposit rate offered by commercial banks is determined by yields obtainable on earning assets, ceiling restrictions, rates paid by competing savings institutions, and variables reflecting their portfolio structure. The rates set by other institutions will in turn depend on commercial bank rates, conventional mortgage rates, and other long-term rates. The model underlying the demand for "savings type" deposits is specified as a logarithmic stock-adjustment process, where the equilibrium stock is related to interest rates, household net worth, population, and prices.

In general, our estimates of the parameters of the equations for the demand for and supply of deposits were quite satisfactory. The equations fit the data well and produce low standard errors. Of the various flows, passbook savings at member banks are the most sensitive to changes in interest rates. The one disappointing feature of our estimates was the rather low values derived for the speeds of adjustment in the case of savings and loan shares and mutual savings bank deposits.

The supply of mortgages in turn depends heavily on the flow of deposits into commercial banks, savings institutions, and life insurance companies. In the case of commercial banks, the relation between the flow of time deposits and the mortgage supply is modified by their deposit composition and the structure of interest rates. For savings and loan associations, who are restricted by statute primarily to "investment" in mortgages, the supply of mortgages is determined completely

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ket discussed in this section have only recently been completed. They have not been fully incorporated into the system on which the simulation experiment reported in the concluding section was conducted. In that system a single mortgage rate equation describes the mortgage market.

[24] In addition, passbook savings deposits at member banks influence the demand for earning assets by these institutions.

by the flow of funds into savings and loan shares. In the case of both mutual savings banks and life insurance companies, who have alternative opportunities for "investment," the relation between the supply of mortgages and the savings flows is affected by the relative position of mortgage rates and yields on other securities. The demand for mortgages is specified to be a function of the mortgage rate, current and lagged, current and lagged housing starts, and the stock of housing. The mortgage rate is determined by the supply of and demand for mortgages, where the total demand for mortgages is equal to the supply of mortgages by the various financial institutions and the holdings of FNMA.

VIII. *Simulations and Summary*

We have often stated that some equation is "satisfactory." Such a judgment at this stage of our work indicates that the single equation estimates of a particular function are in accordance with our a priori expectations, and that other statistical properties of the estimates, such as the variance-covariance matrix of the estimates, the serial correlation of the residuals, and the overall standard error of estimate do not cause any alarm. However, the final criteria for the acceptability of individual equations, when the equations constitute a complete model, must be derivable from criteria for the model as a whole. Thus, we cannot base our final judgment of individual equations on the standard statistical procedures applicable for the single equation estimation. Unfortunately, criteria for judging the performance of a model as a whole are not well developed in the literature. Past experience of others who have worked extensively with large econometric models indicates that, whatever the criteria that we will finally adopt for making judgments about the performance of the model, it would be most surprising if the ability of the model to simulate the sample period and to forecast two or three years beyond the sample period did not matter. In view of this, we have attempted some simulation analysis of the model for the sample period and some forecasting beyond the sample period, before our model is finalized. We expect to utilize the results of these experiments as an aid in determining which of our individual equations must be improved.

Before we proceed to describe our initial simulation results, a brief comment on the question of simultaneous equation bias is in order. We have not yet devoted a great deal of effort to considering this statistical problem. Part of the reason for the lack of progress in this area is that some of the specifications in our model make it difficult to apply existing techniques of simultaneous equation estimation. Examples of such specifications are nonlinearities and autoregressive error structures,

which constitute an important part of the specification of our model. Furthermore, in some of our important equations, we feel that the simultaneous equation bias is not too severe, due to the long lags involved. In some sectors, where these comments do not apply, we have conducted some experiments with instrumental variable estimation, but with generally inconclusive results. The most that we can say at this stage of the project is that we plan to pursue this problem more systematically in the future.

A. *Simulation Prediction Experiments.*[25] DeLeeuw and Gramlich [7] have carried out a series of experiments in which they forecast the values of endogenous variables for 1965 and 1966, using several subsectors of this model estimated through 1965.[26] The predicted values of GNP are within $1.5 billion of the observed values through the third quarter of 1966, but this error is noticeably larger in the fourth quarter of 1966 ($9 billion). The simulated values for various components of aggregate demand exhibit somewhat larger divergence from their respective observed values, with the largest errors in 1966:4. In the monetary sector, simulated values for demand deposits were within $.6 billion of the observed values throughout the period. Severe errors were observed in the simulations of the Treasury bill rate in 1966:1 (38 basis points) and 1966:2 (34 basis points), but in other periods, errors in this series were less than 25 basis points. The predicted values for the corporate bond rate were quite accurate throughout the period, with the largest error being 29 basis points (1966:2).

A quite different experiment, which seems worth reporting, is an attempt to reproduce the behavior of the economy over the period 1958–65 (32 quarters).[27] The purpose of this experiment is to discover any severe defects of the model which would cause a tendency for it to deviate drastically from the actual time path of the economy. The simulations using values of lagged endogenous variables generated within the model and running over such a long period of time (eight years) should enable us to detect such defects of the system. In Figure 1, we exhibit the comparison of actual and predicted values of GNP (*XOBE*). The figures presented in Figure 1 indicate that our model is capable of tracking the general pattern of the actual time path of the economy,

[25] The simulation methods used for this model are based on the Gauss-Seidel technique and were programmed by Morris Norman [25].

[26] These predictions are based on the observed values of the exogenous variables, but the values used for the lagged endogenous variables are those generated by the simulation. These experiments are based on an incomplete model in which all prices and wages are taken as exogenous.

[27] This simulation is based on a slightly different version of the model from that used by DeLeeuw and Gramlich. Again, the observed values of the exogenous variables are fed into the system, and we use the values of the lagged endogenous variables generated in the model. As in the DeLeeuw and Gramlich experiments, we take all prices and wages as exogenous in this experiment.

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1957  4    ●   ℰ*                                                          ●
1958  1   ●ℰ  *                                                            ●

1958  2    ● ℰ*                                                            ●
1958  3    ●  * ℰ                                                          ●

1958  4    ●   * ℰ                                                         ●
1959  1    ●   *    ℰ                                                      ●

1959  2    ●     *    ℰ                                                    ●
1959  3    ●      *  ℰ                                                     ●

1959  4    ●     *    ℰ                                                    ●
1960  1    ●     *       ℰ                                                 ●

1960  2    ●      *     ℰ                                                  ●
1960  3    ●        *   ℰ                                                  ●

1960  4    ●       *   ℰ                                                   ●
1961  1    ●         *  ℰ                                                  ●

1961  2    ●            *  ℰ                                               ●
1961  3    ●             *   ℰ                                            ●

1961  4    ○              *   ℰ                                          ●
1962  1    ●               *   ℰ                                         ●

1962  2    ●                 *  ℰ                                        ●
1962  3    ○                 * ℰ                                         ●

1962  4    ●                  *   ℰ                                      ●
1963  1    ●                    *  ℰ                                    ○

1963  2    ●                      *  ℰ                                  ●
1963  3    ●                       *   ℰ                                ●

1963  4    ●                        *   ℰ                               ●
1964  1    ○ RANGE  437.76  TO  631.18        *ℰ                        ●

1964  2    ○                                 *ℰ                         ●
1964  3    ○                                    *ℰ                      ●

1964  4    ●                               *                            ●
1965  1    ●                                     * ℰ                    ●

1965  2    ●                                           *          ●   ●
1965  3    ●                                             *   . ●

1965  4    ●                                                      *○
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FIGURE 1

although there are a number of problems in detail. As in the experiments by DeLeeuw and Gramlich [7], the prediction of the components of aggregate demand are somewhat inferior to the prediction of GNP. In particular, though we do not report the details, it is evident that the equations for consumer durables and some parts of the housing sector will have to be improved. Compared to the performance of other

TABLE 1

PROVISIONAL MULTIPLIERS FOR SELECTED PERIODS $(t+i)$

i	Federal Reserve Bank Credit	Federal Government Defense Expenditures	Federal Personal Income Tax (absolute value)
−1	—	.559	—
0	.279	2.320	1.15
3	1.710	4.554	3.55
7	6.361	5.187	3.58
11	10.108	5.529	3.62

existing models at a similar stage of development, the performance of this model is fairly encouraging.

The final experiment which we report here is a calculation of the multipliers on GNP with respect to various monetary and fiscal policy parameters. We have chosen a change in Federal Reserve bank credit (currency plus unborrowed reserves) as a proxy for open market operations, a change in federal government defense expenditures, and a change in the federal personal income tax. These multipliers represent the difference in the time paths of two simulations: (1) the historical path described above (presented in Figure 1) and (2) the time path generated under an exogenous (and nonstochastic) shock applied and maintained through a change in the relevant policy parameters.[28] In each case the simulations used the lagged values of the endogenous variables generated in the system. Multipliers for up to twelve periods are presented in Table 1.

The open market multiplier suggests that our conclusions about the ultimate strength and relatively weak immediate effects of monetary policy are justified. Those who are convinced that "money matters" will be encouraged by the 12-quarter multiplier of 10, while at the same time proponents of aggressive monetary policy as an instrument of cyclical stabilization will be disappointed to note that it takes almost 2 years (7 quarters) for 50 percent of this 12-quarter effect to be realized. Only 17 percent is realized after one year. (This is conditional on our interim specification of the housing market.) The multipliers for defense expenditures and federal personal income after 12 quarters are smaller than that of open market operations, but the time paths are markedly different. These two fiscal policy actions attain 75 percent of their 12-period effect after 3 and 2 quarters, respectively. In addition, defense

[28] The assumed magnitudes of the policy actions were: a $1 billion increase in Federal Reserve bank credit; a $5 billion increase in real defense expenditures; and a 10 percent surcharge on the federal personal income tax. The tax multiplier was calculated by normalizing the change in GNP by the change in tax revenue in the contemporaneous period. The nonlinearities implicit in the model imply that the magnitude of any multiplier may be sensitive to the magnitude of the exogenous shock and to the initial conditions for the endogenous variables.

expenditures have an impact in the quarter before delivery of defense goods. Both of these fiscal policy multipliers are higher than those of other aggregate econometric models [9] [16]; but at this preliminary stage, we have not thoroughly investigated the causes for this difference.

B. *Summary and Plans for Future Work.* A great deal more work will be required before the model can be considered reasonably complete. However, we find the results obtained so far, including the results of initial predictions and simulation experiments reported above, sufficiently encouraging in the sense that: (1) the basic structure of the model as it stands now will remain substantially intact through our future efforts to improve the model and (2) with some hard work, we should be able to make the model operational for the purpose with which we started our work.

In order to gain an overview of how our model works, it is most instructive to outline the chain of reactions that follow in the model after some policy action is instituted. Given the limitation of space, we will consider only two policy actions: an open market operation to increase the supply of Federal Reserve credit and an increase in the rate of federal personal income taxes.

When Federal Reserve credit is increased, the immediate reaction is an increase in reserves. This, through the supply function of demand deposits by commercial banks and its interaction with the demand for money, affects the short-term rate of interest. This process is modified by the activities in the commercial loan market. A change in the short-term rate of interest, through the term structure equation, affects the long-term rate with, of course, a time lag. The long-term rate will affect the cost of capital directly as one of its components, and indirectly through the dividend/price ratio, which is also a component of the cost of capital. The cost of capital in turn enters the demand functions for final outputs at three points: in the demand function for producers' durables through the relative price term; in the demand function for nonresidential structures, again through the relative price term; and in the equation determining the price of residential houses. The variatiõn in the relative price terms in the demand functions for producers' durables and structures will affect the demand for these items with time lags. Once the demand for these items changes, the effects will move through the economy via the standard multiplier process.

In the housing sector, the change in the price of houses affects housing starts. In addition, the change in the long-term rate will affect the interest rate on mortgages.[29] The mortgage rate in turn directly affects

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[29] In the present version of the model, this effect is transmitted through a rate structure equation which relates the mortgage rate directly to the corporate bond rate. When the more detailed description of the nonbank financial intermediaries and mortgage market is incor-

housing starts, and indirectly through its role as a component of the required rate of return in the determination of the price of houses, which again feeds into the equation for housing starts.

The long-term rate enters into the consumer durables equation as a part of the term expressing the relative cost of holding the stock of consumer durables, and, through the budget constraints, into consumer demand for nondurables and services.[30] Finally, the long-term rate enters the expenditure equations for state and local governments, and through their budget constraints, into the revenue functions of these governments.

If a discretionary change in the rate structure of federal personal income tax occurs, we must first go to the tax file constructed by Pechman [26] and compute the corresponding change in the effective tax rate. This effective rate change enters into the equation in our model explaining the federal personal income tax liability, and the liabilities then affect disposable personal income.[31] The rest is the standard multiplier process.

As we have indicated throughout this paper, a number of improvements must be made before this model can be considered a useful tool for analyzing stabilization policies. We must complete our work on labor supply and on prices and wages. Furthermore, in addition to those equations that we presently feel are inadequate, we doubtless will uncover defects in other equations as we carry out intensive simulation analysis and prediction outside of the sample period. The need for well-defined criteria for judging the results of simulation analysis must be filled.

The completion of all this work does not mean that work on a project such as this is finished. Before long, the model in some form will be used to analyze the consequences of policy decisions contemplated by the monetary and fiscal authorities. No one, least of all those who worked on the project, expects that the answers provided by the model will be accepted without question. Rather, it is hoped that the answers provided will be compared with those obtained through other, more traditional, analyses. If both answers agree completely, we will be somewhat disappointed, though this is a remote possibility. Most likely, the two would agree in some respects and disagree in others. This would lead us

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ported in the model, this transmission will be through a more complex equilibrating mechanism of the mortgage market. See Section VII-D above.

[30] When household net worth is introduced into the consumer expenditure equations, effects of monetary policy will be transmitted to consumer behavior through the valuation of this variable.

[31] Note that in the model, disposable personal income is defined on a liability basis rather than on a payment basis.

to inquire about the causes of the discrepancies and hopefully, to a clearer understanding of the process through which stabilization policies work, to better policy formulation, and to improvements in the model as well.

REFERENCES

1. S. Almon, "The Distributed Lag between Capital Appropriations and Expenditures," *Econometrica*, Jan., 1965, pp. 178–96.
2. A. Ando and E. C. Brown, "Personal Income Taxes and Consumption following the 1964 Tax Reduction," in A. Ando, E. C. Brown, and A. Friedlaender, *Studies in Stabilization Policies* (Brookings Institution) (forthcoming).
3. A. Ando and S. M. Goldfeld, "A Model for Stabilization Policies," in A. Ando, E. C. Brown, and A. Friedlaender, *Studies in Stabilization Policies* (Brookings Institution) (forthcoming).
4. A. Ando and F. Modigliani, "The 'Life Cycle' Hypothesis of Saving," *A.E.R.*, Mar., 1963, pp. 65–84.
5. C. W. Bischoff, "Elasticities of Substitution, Capital Malleability, and Distributed Lag Investment Functions." (Unpublished paper presented at the Dec., 1966 meetings of the Econometric Society.)
6. ——, "Lags in the Fiscal and Monetary Impacts on Investment in Producers' Durable Equipment," *Conference on the Effect of Investment Tax Credit and Accelerated Depreciation on the Level of Investment* (Brookings Institution) (forthcoming).
7. Frank deLeeuw and E. M. Gramlich, "The Federal Reserve-M.I.T. Econometric Model," *Fed. Res. Bul.*, Jan., 1968.
8. O. Eckstein, "Money Wage Determination Revisited" (unpublished).
9. M. Evans and L. R. Klein, *The Wharton Econometric Forecasting Model* (Univ. of Pennsylvania, Economics Research Unit, 1967).
10. G. Fromm and P. Taubman, *Policy Simulations with an Econometric Model* (Brookings Institution) (forthcoming).
11. E. M. Gramlich, "State and Local Governments and their Budget Constraint," *Int. Econ. Rev.* (forthcoming).
12. R. E. Hall and D. W. Jorgenson, "Tax Policy and Investment Behavior," *A.E.R.*, June, 1967, pp. 391–414.
13. D. Jaffee, "The Commercial Loan Market and Credit Rationing." (Unpublished paper presented at the Dec., 1967, meetings of the Econometric Society.)
14. D. W. Jorgenson, "Capital Theory and Investment Behavior," *A.E.R.*, May, 1963, pp. 247–59.
15. E. Kuh, "A Productivity Theory of Wage Levels—An Alternative to the Phillips Curve," *Rev. of Econ. Studies*, Oct., 1967, pp. 333–60.
16. M. Liebenberg, A. A. Hirsch, and J. Popkin, "A Quarterly Econometric Model of the United States: A Progress Report," *Survey of Current Business*, May, 1966, pp. 13-39 (U. S. Department of Commerce, Office of Business Economics).
17. J. Lintner, "Distribution of Income of Corporations among Dividends, Retained Earnings, and Taxes," *A.E.R.*, May, 1956, pp. 97–113.
18. S. J. Maisel, "A Theory of Fluctuations in Residential Construction Starts," *A.E.R.*, June, 1963.
19. ——, "Non-Business Construction," in *The Brookings Quarterly Econometric Model of the United States*, J. Duesenberry, *et al.*, editors (Rand McNally and North-Holland Publishing Co., 1965).
20. M. H. Miller and F. Modigliani, "Some Estimates of the Cost of Capital to the Electric Utility Industry," *A.E.R.*, June, 1966, pp. 333–91.
21. F. Modigliani and R. Brumberg, "Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data," in *Post-Keynesian Economics*, K. K. Kurihara, editor (Rutgers Univ. Press, 1954), pp. 388–436.
22. F. Modigliani and M. Miller, "The Cost of Capital, Corporation Finance, and the Theory of Investment," *A.E.R.*, June, 1958, pp. 261–97.
23. F. Modigliani and R. H. Rasche, "Central Bank Policy and the Money Supply." (Unpublished paper presented at the Aug., 1967, meetings of the Western Economic Association.)
24. F. Modigliani and R. Sutch, "Innovations in Interest Rate Policy," *A.E.R.*, May, 1966, pp. 178–97.

25. M. R. Norman, "Solving a Nonlinear Econometric Model by the Gauss-Seidel Iterative Method." (Unpublished paper presented at the Dec., 1967, meetings of the Econometric Society.)

26. J. A. Pechman, "A New Tax Model for Revenue Estimating" in *Government Finance and Economic Development*, A. T. Peacock and G. Hauser, eds. (OECD, Paris, 1965). Reprinted in the Brookings Institution reprint series, Number 102.

27. G. L. Perry, *Aggregate Wage Determination and the Problems of Inflation* (M.I.T. Press, 1966).

28. E. S. Phelps, "On the Theory of Money Wage Dynamics and Its Complications for the Phillips Curve." (Unpublished paper presented at the Dec., 1967, meetings of the Econometric Society.)

29. A. W. Phillips, "The Relation between Unemployment and the Rate of Change of Money Wages in the United Kingdom, 1951–1957," *Economica*, new series, Nov., 1958, pp. 285–99.

30. Research Seminar in Quantitative Economics, "The Economic Outlook for 1968." (Mimeographed, Univ. of Michigan.)

31. N. J. Simler and A. Tella, "Labor Reserves and the Phillips Curve," *Rev. of Econ. and Statis.* (forthcoming).

32. G. A. Sparks, "A Model of the Mortgage Market and Residential Construction Activity." (Unpublished paper presented at the Dec., 1967, meetings of the American Statistical Association.)

33. P. Tinsley, "Variable Weight Distributed Lags: An Application to the Supply of Machinery and Equipment." (Mimeographed, Division of Research and Statistics, Board of Governors of the Federal Reserve System, 1966.)

34. P. Tinsley and A. Tella, "The Labor Market and Potential Output: A Simulation Study." (Unpublished paper presented at the Dec., 1967, meetings of the American Statistical Association.)

DISCUSSION

CARL F. CHRIST: I am delighted to take part in this session commemorating the centenary of the birth of Irving Fisher—one of the greatest of economists. It is a particular pleasure to be asked to discuss the paper by Professors Brainard and Tobin. It appeals to me greatly.

The problem chosen is to understand the interplay between the real and the financial sectors of the economy. For this purpose Tobin and Brainard have given us, in effect, four models, falling into a 2×2 classification as follows: static versus dynamic models; and purely financial models, with all real quantities exogenous, versus extended models that explain real income and other variables in the real sector. I will summarize first, and then comment.

In all four models, there are 3 sectors: government (including the Federal Reserve), banks, and the public.

The static purely financial model may be summarized as follows. There are four exogenous variables that will be made endogenous in the extended model; these four are the marginal efficiency of capital, r, real income, Y, the real capital stock, K (valued at replacement cost), and the total of private holdings of government-issued paper assets, G (being the sum of high-powered money, R, plus short-term government debt, the latter held partly by banks, S^b, and partly by the public, S^p).

The additional exogenous variables, which will remain exogenous in the extended model, are the rates of interest on demand deposits, r_D, time deposits, r_T, and Federal Reserve discounting, r_F; required reserve ratios on demand deposits, k_D, and time deposits, k_T; the high-powered money stock, R; and the general price level (which does not appear explicitly because it is taken to be equal to 1).

The static financial model has twelve endogenous variables and twelve independent equations. The endogenous variables include one price level for capital goods, p, three interest rates, and eight stocks of financial assets or liabilities. The three endogenous interest rates are for capital goods, r_K, bank loans, r_L, and short-term government securities, r_S. The eight endogenous stocks, all in money terms, are excess reserves, E, bank loans, L, demand deposits, D, time deposits, T, government securities held by banks, S^b, and by the public, S^p, the market value of capital, V, and the public's wealth, W^p.

There are five behavior equations for the public: four demand equations for demand deposits, time deposits, government securities, and real capital, and one supply equation for bank loans (considering loans to be an asset evidenced by promissory notes, in the same manner as securities). The public holds no high-powered money. These five equations are dependent; when added up, they yield the balance-sheet equation for the public.

There are three behavior equations for the banks: demand equations for excess reserves, government securities, and loans. The banks are considered as quantity-takers for demand and time deposits, accepting whatever

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amounts of these the public chooses at the exogenous interest rates set for deposits by the authorities. (Actually, Brainard and Tobin assume that the authorities set only ceiling rates for deposits, but that these ceiling rates are always the actual rates. For this to be so, they implicitly assume that the behavior equations describing how banks would set deposit rates in the absence of ceilings are such that the free-market rates are always at or above the ceilings, for all time-paths studied.) These three bank behavior equations are dependent; when added up with demand and time deposits, they yield the balance-sheet equations for banks.

There are four more equations. Two of them are definitions: The rate of return on capital, r_K, is the marginal efficiency of capital r divided by the price level of capital goods, p. And the market value of capital goods, V, is their price, p, times their real quantity, K.

The two remaining equations are equilibrium conditions for high-powered money: R equals required reserves plus excess reserves, E; and for government securities: S^b plus S^p equals the supply; namely, $G - R$. This supply is exogenous in the financial model.

Included among these twelve equations, or obtainable from them by appropriate substitutions and summations, are balance-sheet identities for the three sectors, equilibrium conditions for the six assets, and the definition of the public's wealth as the sum of government-issued paper assets, G, plus the market value of real capital, V. The twelve equations form a system that is complete and consistent.

The dynamic financial model includes the same twelve equations, except that the eight behavior equations are now to be reinterpreted as showing desired rather than actual levels of stocks of assets. Of course, this introduces eight new variables; namely, the public's desired levels of demand deposits, time deposits, government securities, real capital, and loans, and the banks' desired levels of loans, government securities, and excess reserves. There are eight additional equations not in the static model; these describe the adjustment of eight actual variables in response to differences between the desired and actual levels of the various stocks of assets. Thus the dynamic financial model has twenty equations in twenty endogenous variables.

The five adjustment equations for the public sector are dependent, constrained to satisfy the public's balance-sheet equation. Similarly, the three adjustment equations for the banks are dependent, constrained so that with demand and time deposits they satisfy the banks' balance-sheet equation.

The two extended models, static and dynamic, are formed by joining four equations to the corresponding financial model, as follows: (1) The marginal efficiency of capital, r, is made to depend on the lagged output/capital ratio, Y_{-1}/K_{-1}. (2) Output, Y, depends on investment, ΔK, and government purchases and the tax rate by a simple multiplier process. (3) Investment is an increasing function of the difference between the market price of capital, p, and its replacement cost, the latter being exogenous and set equal to 1. And (4) the change in G, the stock of government-issued paper assets, is

equal to the budget deficit; i.e., to government purchases less taxes, where taxes are the product of income by the tax rate.

Thus the static extended model has sixteen variables and equations, while the dynamic extended model has twenty-four.

These models have many realistic features. Especially important are asset demand equations carefully designed to have the required dependence so that within each sector they add up identically to the sector's balance sheet; the government budget restraint (in the extended model) showing that the change in high-powered money plus government securities must equal the government deficit; investment incentives (in the extended model) whenever the market-clearing price of the existing stock of capital goods exceeds their cost of production; and (in the dynamic models) an adjustment process describing the response to disequilibrium, also constrained to satisfy sector balance sheets.

There are other features less desirable, no doubt introduced for the sake of simplicity. I mention a few.

It will seem strange to many of you that in a model of financial variables and policy effects, the general price level is not explained, but is exogenous. The reason for this is that even the extended model has no production function and no provision for a capacity level of output. It is an aggregate demand model only, with no provision for aggregate supply. Hence it cannot determine both real output and the general price level. We must choose to regard one of these variables as exogenous. The "classical" extreme is to regard output as exogenous (presumably at some unexplained full employment level), and then let the model determine the price level. The authors choose instead the "Keynesian" extreme of regarding the price level as exogenous, and then letting the model determine real output. A more satisfying, but more complex, alternative would be to include in the model an aggregate supply mechanism, and an adjustment equation to determine the current price level in response to the inflationary or deflationary gap of the preceding period.

The real sector of the extended model is too simple; it says that aggregate demand is unaffected by changes in wealth, or in any interest rates except the marginal efficiency of capital.

The authors have disaggregated the private sector into two parts: banks and the public. Now of course the banks are owned by the public; therefore the net worth of the banks should appear on the liability side of the banks' balance sheet, and on the asset side of the public's balance sheet. It does not appear at all, presumably because it is small enough so that the authors have chosen to neglect it.

The assumption is made that the public does not hold currency; i.e., that all the high-powered money is held as reserves by banks. This simplifies matters, but it also removes one of the main sources of uncertainty that bedevils banks; namely, the prospect that depositors may withdraw currency and thus squeeze the reserve position of the banks.

The asset demand and supply equations of the public have a convenient but possibly unrealistic form; namely, they require that as wealth rises or

falls, with income and interest rates constant, the quantity of every asset demanded rises or falls in proportion.

The banks' asset demands have a convenient but incorrect form; namely, they are homogeneous of first degree in what the authors call disposable demand deposits and disposable time deposits. These useful terms refer to the amount of deposits less required reserves. The incorrectness can be seen as follows. Imagine that required reserves against both demand and time deposits are 15 percent, so that disposable deposits are 85 percent of total deposits. And imagine that, at current interest rates, banks want to hold excess reserves amounting to 1 percent of disposable deposits. Then total reserves are 15.85 percent of deposits. This is quite plausible. Now suppose that the required reserve ratio is cut to zero and that interest rates do not change. Then disposable deposits are 100 percent of total deposits. And excess and total reserves are only 1 percent of deposits. This is clearly not right. One remedy, again more complex, would be to postulate a demand function for bank reserves and then assume that banks will hold either the amount demanded or the amount required, whichever is greater.

The authors plead correctly that whenever a variable affects any sector's demand for any asset, that same variable must affect that sector's demand or supply of at least one other asset. They further urge model builders to provide for effects upon all of that sector's demand and supplies for other assets. And yet they do not follow their own advice in drawing up the desired balance-sheet equations in Table 2; in particular, they specify that the loan rate, r_L, affects the public's supply of loans offered to banks and its demand for real capital, but does not affect its demand for deposits or government securities.

The authors say (Section II) "deviations of actual from desired values must always add up to zero" for any sector, because its actual and its desired asset values are both constrained to add up to the same total; namely, that sector's wealth. This is correct, as long as the desired and the actual values refer to the same point of time, so that the two wealth levels to which they are constrained to add up are indeed the same. But the authors say later (Section III) that for the public, the deviations $X^{**}(t)$ $-X(t-1)$ of desired level of balance-sheet items at time t from actual levels at time $t-1$ must add up to zero when summed over all balance-sheet items. Now this will be true only if wealth at time t (to which desired asset levels at time t must add up) is the same as wealth at time $t-1$ (to which actual asset levels at time $t-1$ must add up); that is, only if wealth has not changed from time t to time $t-1$. One way to remove this difficulty would be to revise the private nonbank sector's desired balance-sheet equations as given in Section III, so that desired holdings for period t are made to depend on (and add up to) actual wealth in period $t-1$. Perhaps this is what the authors intended.

In Section VI, the authors present a simple adjustment model as follows:

(i) desired demand$_t = f(\text{price}_t)$

(ii) Δ actual demand$_t = \alpha(\text{desired demand}_t - \text{actual demand}_{t-1})$

(iii) actual demand$_t = $ exogenous supply$_t$.

Actual demand is determined in (iii), being equal to the exogenous supply. Then in (ii) the only as-yet-undetermined variable is desired demand, so (ii) shows that desired demand is determined by actual demand. (Surely the causation should run the other way in this adjustment equation.) Then in (i), the remaining variable, price, is determined by desired demand. Now look at the dynamic adjustment equations in the authors' main model: they are just like the adjustment equation (ii) in the three-variable model, in that current actual demand does not depend on current price directly, but only on the deviation of current desired demand from lagged actual demand. This kind of model gives the plausible result, on combining the adjustment equation with the demand equation, that actual demand depends on current price and lagged actual demand, and that exogenous supply and lagged actual demand determine current price. But it is implausible in that the adjustment equation itself does not contain price, so that the causal influence in the adjustment process is required to run from actual demand to desired demand. What we need is an adjustment equation that incorporates price in such a way that in equilibrium the change in actual demand is zero. One example might be

$$\Delta(\text{actual demand}_t) = \alpha(\text{desired demand}_t - \text{actual demand}_{t-1}) + \theta(\Delta \text{ price}_t)$$

where θ is negative. Another example might replace Δ price by the deviation of actual from expected price; then another equation would be needed to explain expected price.

Expectations do not appear in the model.

The simulation results are very interesting, for the static models and especially for the dynamic ones. Of course they must be taken as suggestive rather than as definitive, because the equations of the model are at best plausible conjectures rather than verified empirical laws. But the suggestions are very strong in some respects. In particular, note the fact that the cyclical phase relationships among variables are strongly affected by the kind of policy being pursued. The moral for the user of the "leading indicators" technique for forecasting is obvious.

REGIONAL ECONOMIC MODELS

GROWTH AND CAPITAL MOVEMENTS AMONG U.S. REGIONS IN THE POSTWAR PERIOD

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Summary

I shall present one of a large group of open neoclassical growth models, which are useful for the analysis of borrowing and lending among regions and countries. I shall derive time path solutions for the rate of investment, the rate of external borrowing, and the flow of income payments on external borrowing. Numerical estimates will be constructed and compared to actual behavior. The statistical comparisons are promising, and indicate the usefulness of such models in analysis of growth.

Introduction

Borrowing and lending among regions may be analyzed in the same fashion as among countries. The transfer of resources is accomplished when the lender or grantor experiences a surplus in its current account balance of payments, offset by a deficit in its capital or transfer accounts. The movement of resources may be financed through private or governmental channels, through short- or long-term instruments of debt or through equities. Excluding grants and gifts from consideration, transfers of capital are ultimately followed by a reverse flow of income representing interest and dividends and by repayment when debt instruments fall due at maturity. The function of borrowing and lending among regions is to equalize the rates of return among competing investment opportunities. Capital will flow from areas of high savings and low investments to areas of low savings and high investment. To the extent that investment levels are related to rates of growth, it means that capital will also flow from slowly to rapidly growing regions.

Capital movements into a region are the sum of net private and net governmental borrowings. The net private borrowings consist of the difference between private investment and savings; the net government borrowings consist of the governmental deficits. Each type of borrowing generates a return flow of income payments representing interest and dividends. A region which in the past has been a net borrower will show in its current account balance a negative item representing the payment

of income to foreign owners or lenders of domestically employed capitals. Conversely, a net lender will show a positive item representing the receipt of income.

Flows of current borrowing and of current income on past amounts borrowed are of considerable quantitative importance in the balance of payments of U.S. regions. The following tabulations use Romans' data on savings and on the current account balance of various states, and use my own estimates of net income on private external borrowing [1] [2].

a) In 1953, thirty states were net borrowers on current account, such borrowings accounting for an average of 34 percent of the sum of gross state savings and borrowings.

In 1953, eighteen states were net lenders on current account, such lending amounting to an average of 39 percent of gross state savings.

b) Net income on external borrowing or lending exceeded the whole current account balance (both in absolute value) in ten states; and exceeded one-half the current account balance in twenty-six states.

c) Net income on external borrowing or lending varied from +21 percent to −11 percent of received state income, measured on a national income basis.

The reverse flow of interest and dividends reflects the past values of the current account balance of payments. If we assume that all borrowing had taken place at a particular and unchanged rate of interest, we could write the following definition:

$$(1) \qquad\qquad D_t = r \sum_{\tau=0}^{t} B\tau$$

where B_τ represents the value of the current account balance of payments at time τ, which runs from the beginning of history up to time t; and D_t represents the flow of income paid to our lenders at time t. It also follows that $\dot{D}_t$, the change in D_t from one period to the next, depends on the value of the balance of payments at time t.

$$(2) \qquad\qquad \dot{D}_t = rB_t$$

We may also examine income on outside investment through the definitions of the region's produced and received income. Anticipating a model to be presented later, write Z as the received income and XP as the produced income of a region. Then we have

$$(3) \qquad\qquad Z = XP + D$$

Using the dot to represent the time derivative, this implies

$$(4) \qquad\qquad \dot{Z} = (\dot{XP}) + \dot{D} = (\dot{XP}) + rB$$

We also know from the definitions of national product that B equals net lending or borrowing, the sum of savings plus taxes minus investment plus government spending. In all of the following, borrowing by government will be ignored.[1]

The balance of payments on current account Bc will be treated as equal to the excess of private savings over private investment.

(5) $$Z = (XP) + r[S - I]$$

Savings will be treated as a function of the level of received income, and investment as a function of the change in produced income. With the aid of appropriate assumptions generating the time path of produced income, it is possible to analyze the investing and borrowing behavior of regions, within a dynamic framework. Solutions are obtained for the time paths of savings, investment, the current account balance of payments, and the flow of net income on past borrowing.

The following section presents a simple growth model and the time path solutions for the dependent variables. The qualitative implications of the analysis are that, other things unchanged, a region will increase its lending if its savings propensity rises, if its growth rate declines, and if its capital-output requirements decline. In addition, a region will respond to higher interest rates by lending more, or borrowing less. One last result is that improvement in the terms of trade will induce borrowing. This result is more specialized than the others, however, and only occurs when capital goods cannot be produced at home.

The Simple Model

Definition of Variables

Z Received income
C Money value of consumption
XP Produced income
X Physical output
P The national price of X
L Labor
K Units of accumulated capital
D Flow of income on external investment or borrowing
r National interest rate
Xc Consumption of X
Xe Export of X

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[1] There are two reasons for ignoring government borrowing in this model. First the data used to measure state income payments on external borrowing relate only to private borrowing. Data are available measuring state interest payments on state and federal debt. They would have to be used with caution, however, because federal fiscal operations in a state do not generate interest payments on federal debt commensurate with the federal deficit or surplus in that state.

M Flow of imported capital goods

P_k The nation's price of capital goods

S Money value of savings

B Balance of payments on current account

I Money value of investment

Definition of Coefficients

α Savings ratio

a Elasticity of output with respect to capital

A Technology index

ρ Rate of growth of output price

λ Rate of growth of labor force

Relationships in the Simple Model

1. $Z = XP + D$
2. $Z = C + S$
3. $C = XcP$
4. $S = \alpha Z$
5. $D = r \sum B$
6. $B = XeP - MPk + D$
7. $X = A(t)L^{1-a}K^a$
8. $rKPk = aXP$
9. $r = \bar{r}$
10. $Pk = \overline{Pk}$
11. $P = Poe^{\rho t}$
12. $L_t = Loe^{\lambda t}$
13. $X = Xc + Xe$
14. $M = \dot{K}$
15. $I = \dot{K}Pk$

The model depicts a region at full employment; in competitive equilibrium with respect to the use of labor and capital; and in aggregative equilibrium, in the sense that aggregate demand equals aggregate supply. The economy grows through time in a physical sense, because of the growth of the labor supply, because of shifts in the production function due to technological change, and because of the accumulation of an imported capital good. As a matter of analytic convenience, I have left out of consideration the import of consumer goods. The output of the economy also grows in money value relative to the output of other regions because of growth in P, the price of its output. As a simplification it is assumed that the nation's demand for Xe is infinitely elastic at P, and that P changes over time at the rate ρ. This elasticity assumption is needed to develop a steady state growth rate for the regions'

income and product. Alternative assumptions about the elasticity of demand for exports could be incorporated.

The above model leads to solutions for the time paths of the major dependent variables Z, D, Bc, and I. The method of solution may be sketched out briefly by substituting equations (4), (8), and (15) of the model into equation (5) presented earlier.

(6) $$\dot{Z} = (\dot{XP}) + r\alpha Z - a(\dot{XP})$$

note that $XP = XoPoe^{kt}$ where k, the growth rate of gross domestic product, is the sum of λ, $\rho/1-a$, and any effects stemming from changes in the technology index $A(t)$ of the production function. For convenience it is assumed that $\dot{A}/A$ is also constant over time.

(7) $$Z - r\alpha Z = (1 - a)kXoPoe^{kt}$$

This differential equation may be solved to yield the following:

(8) $$Z_t = \frac{(1 - a)kXoPo}{k - \alpha r} e^{kt} + (\text{constant}) \, e^{\alpha rt}$$

which may also be written

(9) $$Z/XP = \frac{(1 - a)k}{k - \alpha r} + \frac{\text{const.}}{XoPo} e^{(\alpha r - k)t}$$

The second term will decay if $(k > \alpha r)$, and we will obtain a positive, steady state value for the ratio of received to produced income.[2] This steady state solution may be used to provide solutions for D/Z, Bc/Z, and I/Z.

(10) $$D/Z = \frac{\alpha r - ak}{(1 - a)k}; \quad B/Z = \frac{[\alpha r - ak]}{r(1 - a)}; \quad I/Z = \frac{a(k - \alpha r)}{r(1 - a)}$$

Bc/Z measures the steady state of a region's borrowing or lending. We see that lending will increase as a proportion of income, when α, the savings ratio, and r, the interest rate, increase. Lending will decrease when

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[2] The stability condition for this model is $k > \alpha r$. This is not a stringent condition to meet since it requires only that a positive fraction of GNP be invested, and that less than 100 percent of output be paid to capital. We may see this result by rewriting equation (5).

(5′) $$\frac{\dot{Z}}{Z} = \frac{kXP}{Z} + r\alpha - \frac{rI}{Z}$$

from which we get

(5″) $$k - \alpha r = \frac{rI}{Z} \frac{(1 - a)}{a}$$

there is a rise in a, the share paid to capital in the production function, and k, the growth rate of domestic product.

We may construct estimates of D/Z, B/Z, and I/Z for each state, by substituting into each solution estimated values of a, r, k, and α.

The Data. There is a small body of data on U.S. regions which can be used to test the above model. In a paper written in 1960, I estimated produced and received national income for U.S. states as of the years 1953 and 1929. The estimates were constructed so that the difference between produced and received concepts would equal only the net earnings of interest and profit on net private borrowing and lending by each state. Thus we have observations on D, Z and XP. The estimates of produced income were partitioned into labor and capital shares, so that we have estimates of a for each state. We do not know the exact value of k, the growth of produced income, because we have only one recent observation on produced income, and one twenty-four years earlier. More recent and more frequent data are available, however, for received income. Accordingly, I used the growth rates of received personal income in the state to measure k, on the assumption that received and produced income would move closely together. I used k as the growth rate of received personal income between 1940 and 1950. The savings ratio α was derived from work done by Romans. He has estimated the volume of net savings in the state for 1953. I assumed that the ratio of savings to income for 1953 was a constant, which was different for each state. We do not have data on r, the interest yield on external borrowing and lending. I have assumed it to be the same for all states, and have approximated its value to provide a reasonable distribution of estimates, borrowers and lenders.

Using the above estimates, I have constructed hypothetical ratios of D/Z for each state.[3] When the hypothetical and actual ratios are compared, the results are most encouraging. A correlation coefficient of $r = +.64$ is obtained between actual and hypothetical estimates of D/Z.

The correlation coefficient is encouraging in view of the errors attending the construction of the data and in view of the other influences on private savings and investment which such simple models obviously ignore.

I would draw the following conclusions from the above. (a) The construction and testing of open growth models is useful in understanding what has happened in the past and what can happen in the future to

[3] I have not constructed numerical estimates of B/Z or I/Z in this simple model. B/Z is very likely dominated by government spending and taxing, both of which would be exogenous to the model. I/Z could be constructed, but could not be compared with actual values of the same variable. The reason is that we have data only for gross investment by state, not for net investment. The model is concerned with net saving, net investment, and predicts all magnitudes net of depreciation. In a model presented later, gross investment is predicted.

borrowing and lending among regions. (*b*) What is applicable to regions should also be applicable to analysis of borrowing behavior among individual countries.

REFERENCES

1. J. Thomas Romans, *Capital Exports and Growth Among U.S. Regions* (Wesleyan Univ. Press, 1965).
2. G. H. Borts, "The Estimation of Produced Income by State and Region," in *The Behavior of Income Shares*, Studies in Income and Wealth, Vol. 27 (N.B.E.R., Princeton Univ. Press, 1963).

INPUT-OUTPUT TECHNIQUES FOR
URBAN GOVERNMENT DECISIONS

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Urban governments, although they have existed for hundreds of years, have never before been as large and complex and such big money spenders as they are today. This paper will be restricted to a consideration of local, urban governments and will present an urban public services expenditure projection model and a regional planning model to evaluate alternative plans in terms of their net fiscal health results. Input-output techniques are employed, though to a different degree, in each model.

Urban Government Expenditure Projections

We would like to propose that intermediate-term expenditure projections be made with the aid of regional input-output methods, where the production of urban public services by cities, counties, and special districts and their expenditures are grouped into distinct industries in the processing matrix.

Before a technical discussion of regional input-output analysis for urban government expenditure projections, a key theoretical issue should be raised.

It would be erroneous to assume that even if future local industrial, commercial, and household sector activities were known, a unique future quantity and quality, and cost, of urban government services to the private sector could be projected. Instead, future expenditure levels will be determined by supply and demand considerations as well as by government's ability to raise the funds required.

Use of the input-output technique forces us to consider expenditures of the urban local government "industry" as analogous to the expenditures of other industries in the matrix, which are assumed to be motivated overwhelmingly by economic incentives. In the urban public sector, motivation and incentives are extremely complex and, more important, services tend to be rendered monopolistically. As a result, it is impossible to relate marginal costs to supply.

On the demand side, matters are complicated by the fact that most urban government services are not sold. The production programs for those goods and services that are sold are not self-supporting; that is, subsidies are received in one form or another, implying that nonusers

of these outputs are among the "purchasers." Therefore there often are no, or only weak, demand signals.

Officials charged with responsibility for supplying urbanites with services appear to be aware of financial constraints—primarily their rather fixed budgets, which can, however, be spent quite differently depending upon what decisions are made about quantities and qualities of services to be offered. They are also aware of legal constraints; for example, the mandate charging governments to provide services for everyone: all children must be given an education, all homes must be protected against fire, and so on. Officials tend to find that the size of their future budget and the number of people to be served are more or less fixed, and that their major adjustments are in the quality of the services they supply. Future expenditure levels will directly reflect the growth in total output in the processing matrix and the relative growth rates of the various industries. The qualities of services offered by public officials to different client groups will vary, depending on the legal "service loads" and budget increases received each production period. Thus we postulate that expenditures can be projected by input-output analysis and the service qualities will depend heavily on voters' behavior and public officials' survival traits.

These considerations are presumably reflected in the input coefficients computed from historical data of the household, manufacturing, and commercial sectors of the urban economy. The use of historical coefficients for projections assumes continuation in the future of these past relationships.

The Model. Our intent is to build an urban government services model that treats urban government as a productive agent—in the input-output usage, an industry whose production level depends on the demand for government services and input coefficients of the other sectors. Since the level of activity of the other sectors depends considerably on their final demand, an ultimate relationship exists between final demand changes of an urban area and expenditures of urban government. We will build a balanced, closed regional input-output model and assume that the relationships between final demand, local private sectors, and urban government sectors are reasonably stable and predictable.

Input-output models assume the existence of a linear homogeneous production function. Both theoretical and empirical analyses suggest that this assumption is reasonable about horizontally integrated local governments, at least over a rather wide range of output. Horizontally integrated services include education, police and fire protection, and hospital services.[1]

[1] For details see Werner Z. Hirsch, "Expenditure Implications of Metropolitan Growth and Consolidation," *Rev. of Econ. and Statis.*, Aug., 1959, pp. 232-41.

Projection of urban government expenditures within a regional input-output framework assumes that, within limits, benefits from urban government services accrue to specified local sectors. Very few urban government outputs are consumed as pure public goods. In fact the exclusion principle could be applied to a majority of urban government outputs and is quite often operative in practice. In some instances, externality or "merit good" considerations prevent us from applying the principle.

Although many national and regional input-output tables include the urban government and household sectors in the final demand segment, such treatment is not warranted in a balanced, closed urban government services model for a specific city or metropolitan area. In large urban areas the activities of these two sectors are closely related to the general level of economic activity within the area. Assuming reasonably stable, full employment conditions, it is useful to consider the households and urban government sectors as parts of the endogenous segment of the economy. Thus the general equilibrium and interaction features of the households, urban government, and business sectors are placed in focus.

In an urban input-output model such as we propose the final or exogenous segment includes federal government, state government, gross private capital formation, and exports. Urban government intermediate-term projections, relating production requirements and expenditures to final demand changes, do not appear to require a major disaggregation of the import requirements by sector.

Disaggregating Urban Government Services Into Five Sectors. In disaggregating local urban government services, we suggest uniformity of demand as the dominant consideration and similarity and stability in supply factors as secondary concerns. Specifically, within limits, sector demand should be sufficiently uniform to be measured by similar factors; for example, road maintenance might be aggregated with street cleaning, simply because the demand for each stems from the community's necessity to take trips to work, shop, and the like. Furthermore, it is useful to separate services on the basis of variables that act as demand proxies; for example, some services are closely related to population growth while others are more closely related to the number and value of physical structures. Finally, the disaggregation technique should relate urban government outputs to specified demanders.

It would be nice if in addition to these demand considerations certain supply considerations would be met; i.e., that the disaggregation facilitate government resource analysis and that the fixed input-output coefficient assumption is met.

The above considerations lead us to disaggregate urban government services into the following five major sectors:

Education, Cultural Activities, and Recreation Services Sector. The education, culture, and recreation services areas are related through citizens' demand for inputs to their intellectual and physical growth. Recreational facilities might be grouped with educational and cultural facilities because they enrich such growth. On the other hand, a good case could be made for including recreation with health services, emphasizing the mental health aspects of recreation. The unifying demand force stressed in our grouping is the degree to which all three represent investments in as well as current consumption by citizens. Benefits accrue directly to those who are served, although there are certain indirect benefits that spill over to others of the population.

Public Health, Hospital, and Welfare Services Sector. These services areas are also similar, because each directly affects people's health and well-being. They fulfill merit wants; economies of scale in their production play only a minor role; and certain of their specific outputs, such as air and water pollution control, enjoy areawide joint consumption.

Protection Services Sector. The protection of life and property from fire, burglary, and other internal dangers—although in the United States fire and police protection are provided by two separate departments and sometimes even by separate governmental units—have much in common, not only on the demand side, but on the supply side. Property values and density are the major determinants of the pattern of spatial distribution of fire houses as well as police stations.

Street Services Sector. The traffic and transit activities of urban governments are related to citizens' demand for circulation in metropolitan areas. This demand is related to the level of economic activity in the area, the density of population within the area, and the sprawl that results in great distances between places of work and places of residence. Road and transport maintenance and operation, street cleaning and lighting, parking and street patrol, motor vehicle licensing and regulation, etc., are all parts of the street services sector and facilitate circulation throughout the metropolitan area. Some affinity can be claimed between street cleaning and refuse collection and disposal, permitting the two services areas to be lumped together.

Water and Sewerage Services Sector. Water supply and sewage disposal can be readily grouped into a single services category since the amount of water taken in by a plant or household largely determines the amount of sewage that leaves it. The demand for these services is mainly related to the number of plants and households in the area; the services benefit in a major way from economies of scale and their social as well as merit want characteristics are relatively insignificant. Electric and gas utilities can be included in this category even though they are often privately supplied.

Implementation of the Urban Government Input-Output Account. The five sectors of local urban government services discussed above lead to the rows and columns in the input-output matrix, which can be implemented in three steps: First, control totals for each sector of local government are estimated. Second, the inputs, that is, purchases, of each sector are allocated to the supplying industrial sector. Finally, output of each sector is allocated to service recipients by industry sectors.

We will use St. Louis, Missouri, as a case study, since we have an input-output table for this metropolitan area. Control totals for all local government services expenditures in the St. Louis Standard Metropolitan Statistical Area in 1955 were estimated at $207,473,000. This total consisted of $203,538,000 local purchases and $3,935,000 imports. With the aid of local government records and U.S. Government Census information, the following estimates for the five local government sectors were made:

Services	Local Purchases	Imports
Education, cultural, recreation...............	$ 99,255,000	$ 20,000
Public health, hospital, and welfare.........	24,792,000	1,852,000
Protection..................................	31,570,000	812,000
Street......................................	33,530,000	1,251,000
Water and sewerage........................	14,391,000	—
Totals..............................	$203,538,000	$3,935,000

The allocation of government services outputs to recipients by industry sectors is somewhat arbitrary and involves various assumptions. Therefore the most straightforward approach is to identify beneficiaries and estimate the proportion of expenditures incurred by servicing each. About who benefits from local government services a variety of assumptions can be made. For example, it can be claimed that households are the sole beneficiaries of public education and thus that the total education output should be allocated to them. On another, extreme assumption all education benefits would be to industry in relation to the present importance of industry, whether that importance is measured in terms of value added or employment. In this case perhaps it would be better to estimate the importance of industry in terms of some expected future industrial mix.

As expected, in all five sectors the labor input coefficient was quite high. The labor input coefficient was highest (88 percent) for the protection services sector and next to highest (73 percent) for the education, cultural, and recreation services sector. These sectors were followed by the public health, hospital, and welfare services sector (65 percent)

and the water and sewerage services sector (62 percent). The labor input coefficient was lowest for the street services sector (55 percent).

A Regional Input-Output Planning Model

Planning models permit conditional predictions and evaluation of outcomes in terms of one or more specific criteria. Either of two distinct procedures can be followed. In one procedure, first, alternative programs are stipulated; then consequences of each alternative are estimated (and, it is hoped, scored) in quantifiable units; and finally the program yielding the highest score is selected. In the other planning procedure, the desired outcomes are stipulated and then different programs are evaluated in terms of the likelihood of their achieving the set goal.[2]

Regional input-output techniques have been applied in a number of planning efforts that use such planning criteria as output, employment, and income.[3] We would like to present a model that can elucidate the implications of exogenous and local private sector forces for the fiscal health of an urban government. Such a model should be useful for analyzing whether a given local industrial development or certain state and federal decisions are likely to result in additions to or subtractions from the net fiscal resources available to a municipal government, urban county government, or city public school system. Admittedly, the net fiscal health criterion, although it is of interest to local officials, can run counter to efficiency and equity.

There are at least two extensions of such a question, each of which is important but at the moment most likely not empirically research-able. The first is, does industrial development within the city limits increase or decrease the ultimate money burden of taxes for people in the region, while services rendered by their public officials remain at the existing level? The second is, does such a development increase or decrease the net benefits accruing to the people in the city, while services remain at the existing level? The relatively weak foundation of tax incidence theory and the great empirical difficulty associated with it appear to prevent answers to the first question and the relatively early state of development of urban government benefit-cost analysis inhibits solutions to the second question.

The Model. A planning model having net fiscal health as its criterion requires estimation of the impact of exogenous and local private sector forces on urban government expenditures as well as revenues.

A model can be built that employs a regional input-output analysis

[2] An excellent example of this second procedure is Roland Artle's, "External Trade, Industrial Structure, Employment Mix, and the Distribution of Incomes: A Simple Model of Planning and Growth," *Swedish J. of Econ.*, 1965, pp. 1–23.

[3] Werner Z. Hirsch, "Application of Input-Output Techniques to Urban Areas," *Structural Interdependence and Economic Development*, Tibor Barna, ed. (Macmillan, London, 1963), pp. 151–68.

together with major side calculations. Such a model only partly integrates urban government services into the regional input-output tables but relates services expenditure and revenue to input-output information, in two stages, with the help of an array of subsidiary and supporting computations. In stage I, a regional input-output model is built that yields information on regional output and income multipliers. With their aid, the impact of changes in final demand on output and income is estimated. In stage II of the analysis, revenue and expenditure implications are estimated from stage I information, using a variety of side calculations.

In stage II of the analysis we look on the revenue side of the planning model at sources of urban government revenue such as property tax base, sales and gross receipts tax bases, income tax base, various user charges, and receipts from other governments. Assuming that urban government output programs financed by user charges are self-supporting or yield only insignificant surpluses or losses to the general revenue budget, we can ignore user charges revenue in an inquiry into net fiscal health since expansions and contractions of services levels will be appropriately offset by changes in revenue. In relation to income taxes, we can use an input-output matrix to directly estimate income effects. From this income information we then can estimate sales implications and sales tax receipts. For analyses made for some purposes, state and federal aid might be ignored.

However, a special model must be constructed to determine the effects of various activities on the property tax base and hence on the net fiscal health of the community. Urban government's property tax receipts are affected by an extremely complicated maze of interactions which can bring about changes in industrial and commercial as well as in residential property tax bases. The direct output—and the indirect and income induced output that is obtained with the aid of the inverse regional input-output matrix—are multiplied by capital-output coefficients to yield estimates of changes in the industrial and commercial property tax base of each sector. At the same time, the direct output and the indirect and income induced output for each sector are multiplied by the sector output-employment ratios to yield sector employment estimates. The worker-family ratio is used to convert the employment figure into number of family figures for each sector. With the aid of data on family income by sector and an income-residential property value coefficient, residential property value per family per sector is obtained. Each of these values, multiplied by the number of families per sector, yields an estimate of residential property values per sector. Finally, estimates of sector industrial and commercial property value changes, on the one hand, and of residential property changes, on the other, are

multiplied by the property tax rate to yield an estimate of the locally raised property tax.

Estimating the impact of nonlocal government activities on urban government tax receipts in this manner is likely to be superior to direct estimation from the input-output matrix. In the short run, particularly because of business cycles, total output of the area tends to be poorly correlated with the property tax base and tax rate.

Let us next turn to the expenditure side. The expenditure impact model must facilitate estimation of the impact of exogenous and private sector activities on the area's population and property to estimate the services demand of these activities. Again we can start by tracing the initial stimulus that generates the direct and the indirect and income induced sector output changes. Individual public output programs must be described in physical quantities and in dollar values whenever possible. The factors affecting the production of these services are identified, analyzed, and related to the information generated in stage I. With the aid of sector output-employment ratios output can be translated into sector employment which in turn can be translated into population figures from which estimates of school enrollment, patients, welfare recipients, etc., can be made. Furthermore, from the employment or population figures estimates can be obtained of residential, commercial, industrial, and recreational acreages as well as of property values, street mileage, etc.

Implementation of a Net Fiscal Health Planning Model. Since a regional input-output table for the St. Louis SMSA in 1955 is available, a net fiscal health planning model has been implemented in relation to the 16 major industrial sectors of St. Louis, assuming a $1 million increase in final demand in each of them. Instead of estimating the effect of final demand changes on net fiscal health in relation to all local urban government services sectors, this case study concentrates on the primary and secondary public education services subsectors. Full employment and full use of facilities are assumed, so that final demand increases require in-migration and additions to capital and facilities.

In 13 out of 16 industrial sectors increases in the final demand led to losses in net fiscal health.[4] The greatest loss in the net fiscal resources status of the public schools resulted from final demand increases of textile and apparel manufacturing: a $7,356 deterioration of the net fiscal resources status of the public schools resulted from a $1 million demand increase. Industrialization also led to major losses when it took the form of leather and leather products, motors and generators, and lumber and furniture industries. Final demand increases in products

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[4] This estimation related exclusively to local revenue and expenditure. The picture would change somewhat if state aid to local schools were included.

of petroleum and coal, chemicals, and motor vehicles resulted in net gains of \$3,133, \$1,588 and \$748, respectively. Final demand changes produced net fiscal gains in only a few industries and the gains were small—on the average, \$2,415 per \$1 million increase in final demand.

Conclusions

Applying regional input-output analysis to the urban government sector of the economy poses numerous conceptual and empirical problems and we have at best offered partial solutions. We know that past conditions affecting service expenditures are likely to change over time. But we are hard pressed to foresee these changes and incorporate them in our projections. We know also that, for example, water and sewerage services benefit from economies of scale; yet we are forced to use a method that assumes homogeneous production functions. Placing local government and household sectors into the processing matrix offers advantages; it also has disadvantages. The treatment of public capital investment raises serious conceptual difficulties. This, then, is but a small sampling of issues that require further research.

COMPUTER SIMULATIONS, PHYSIO-ECONOMIC SYSTEMS, AND INTRAREGIONAL MODELS*

By John F. Kain *and* John R. Meyer

Harvard University

I. *Computer Simulations and Their Role in the Evaluation of Large-Scale Public Investment Programs*

The advent and rapid improvement of computer technology has transformed economics in but a few short years. Initially, economists simply used computers to do what had been done previously. However, as they became more skilled with the computers and as computers became larger, faster, and cheaper, economists began to conceive of uses that were qualitatively different from those that had preceded. Increasingly, they recognized that large-scale, high-speed computers offered possibilities for developing more complex descriptions or models of social phenomena and began to conceive of the computer as an experimental tool that would permit them to evaluate a wide range of alternatives and to experiment with a large number of alternative formulations. Computer simulation model was the term most commonly applied to this new analytical tool; in some ways, of course, the semantics were less than elegant, since it could well be argued that all models are simulations.

The use of computers has been particularly appealing when evaluating public investments characterized by important externalities, broad social objectives and durable installations (necessitating very long-range planning horizons). Attempts have been made to model such diverse public investments as urban highway systems, urban transit systems, urban renewal programs, water basin development programs, and intercity transportation systems for less developed countries. For such systems, the time and costs required to do computer simulations were easily justified. System complexity, which often took the form of significant nonlinearities in underlying relationships and interdependencies or feedbacks which greatly complicated analytical solutions, made the "brute-force" computational capabilities of the computer attractive, if not mandatory.

Actually, the economist's concern with these problems is of fairly recent vintage. When he arrived on the scene he found the ground
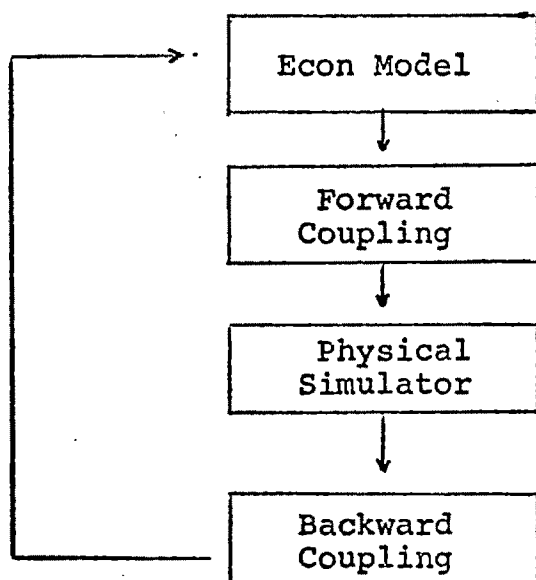
FIGURE 1

GENERAL ECONOMIC-ENGINEERING SYSTEMS SIMULATOR

occupied by engineers. They had made substantial advances in computer simulation of physical systems, e.g., highway networks and river basins, but had also come to recognize the "partial" nature of their systems. They saw a need to extend the simulation techniques to a larger entity and, in particular, to incorporate into the models those activities creating demands on their physical "subsystems."

Almost all of these efforts at larger scale modeling have a fairly common structure. The basic schematic might be described by a simple flow chart as shown in Figure 1. Differences in the structure of these models primarily occur by use of different kinds of feedback loops or different kinds of coupling devices. These feedback loops or coupling devices translate economic entities into physical equivalents for use in the physical simulation subroutines or convert the physical results back into quantities that are interpretable in economic terms.

The concepts can be illustrated by models developed for "comprehensive" urban transportation studies, designed for use in evaluating major transport investments in American cities. Typically, for these urban transportation studies the economic model has been some kind of largely exogenous extrapolation of aggregate regional or metropolitan economic development patterns: the stress is upon industrial growth, changes in the composition of the labor force and employment, the rate of population growth, changes in demographic composition, and so

forth. The regional economic extrapolations are exogenous to the larger transport simulation or modeling in the sense that differences in the intracity transport systems are not expected to measurably influence the basic pattern of economic development in the region or metropolitan area.

In urban transportation models, the forward coupling is usually called "a land use model." The transport model (physical simulator) in these urban transportation studies usually has been limited to estimating the flows of vehicular traffic over the urban highway and street network, and, in particular, on attempting to estimate the effect of different expressway network designs on these flows. However, in some of the more ambitious and inclusive of these studies, attempts have been made to evaluate the effects of providing different kinds of public transit services and facilities such as high-speed express buses and high-performance rail facilities [19]. The backward coupling, when explicitly attempted, is an effort to translate these flows, with their implications for link utilization and congestion, into impacts on future land use patterns. This aspect of urban transportation studies, incidentally, has commonly received much lip service as being indispensable, but very often is quantitatively, if not qualitatively, neglected. This neglect stems from either lack of funds or lack of knowledge of the relevant behavioral relationships.

A very similar structure is visible in the Harvard Macro Economic Transport Simulation Model (labeled the METS Model for short), dealing with problems of transport planning in less developed countries, and in models of water basin development, as pioneered in the Harvard water resources study and applied subsequently elsewhere [22] [18] [7]. The physical simulations in these cases pertain to modeling the operations of national or regional transport systems or of reservoirs, dams, and similar river valley installations as appropriate. In many of these models, full feedback loops have been attempted; that is, the economic model has been treated as endogenous rather than exogenous as in the typical urban model.

Models of a similar design might also be useful in evaluating several other government civilian investment proposals or programs. Among some of the more obvious possibilities would be: (1) the Appalachian highway program; (2) the proposed east-west development road for northern New England; (3) various special water pollution eradication and control programs, such as those proposed for the lower Hudson Valley and Lake Erie; (4) model city demonstrations; (5) high-speed ground transport for the northeast corridor; (6) erosion and pollution control programs for estuarial regions; (7) various proposals for high-performance urban transit; (8) schemes to create greenbelts or other-

wise reserve large chunks of land for public recreational or other uses; (9) a national power grid; and (10) proposals for more publicly "available" satellite communication systems.

None of these studies, it should be noted, would now need to start from scratch. Indeed, we have already learned much that would be valuable for the evaluation of many of the investment undertakings enumerated. For example, experience with both the Harvard METS Model and the "comprehensive" urban transportation studies would be useful in designing models to evaluate regional roads or high-speed ground transport systems. These same models might also be helpful in developing more comprehensive systems for evaluation of proposed power grids or communication networks. Similarly, experience with existing water resource and river basin models should be helpful in developing techniques for evaluating water depollution and estuarial improvements.

II. *The Application of Computer Simulations to Regional and Urban Problems*

While the development of computer simulations has proceeded rapidly in many fields and might be expected to spread soon to new applications, the impact on regional and urban economics has been particularly pronounced. There seem to be at least two reasons for this: urban and regional economics is largely an applied, policy-oriented field, which arose (albeit with a lag) in response to "real" policy problems; and urban and regional analysts found they needed to manipulate large quantities of empirical data.

Indeed, it quickly became apparent that simply adding a locational subscript to the usual economic entities vastly multiplied the number of variables and observations. The handling of these large quantities of data caused urban and regional researchers great difficulty, but these data also provided opportunities. Complex and highly interdependent systems could be modeled that economists studying a single national economy were not even able to contemplate. For these national economies, only a few "historical" experiments recorded in highly aggregative data were normally available.

While it is beyond the scope of this paper to discuss or even enumerate all of the urban and regional models that have been spawned by the burgeoning computer technology, several major classes can be identified. These are:

1. *Regional Models of a Single Region.* One of the first and best known of these in the post-World War II period was that developed by Hoover, Vernon, and associates for the New York metropolitan area, an effort only slightly influenced by computer technology [11] [26]. More re-

cently, there have been the Pittsburgh and the Upper Midwest regional studies, which were rather strongly computer-oriented [21] [9]. In general, these models were intended to evaluate and forecast the condition of particular regions and to propose policies that would improve the regional condition.

2. *Metropolitan Growth Models.* These have typically been inspired by and executed in conjunction with metropolitan transportation studies. The models developed by the Chicago, Detroit, Puget Sound, Boston, Philadelphia (Penn-Jersey), and Southeast Wisconsin Transportation Studies are among the best examples [3] [4] [6] [10] [19] [20]. These modeling efforts were strongly influenced by engineers and transport planners who initially developed elaborate computer simulations to evaluate highway networks and, in particular, new expressway networks. As noted above, development of computer models for forecasting the determinants of urban travel, e.g., land use, seemed a simple and logical extension of these methods. The observation about large quantities of empirical data applies with special force to these studies. A number of "academic" efforts aimed at the development of regional metropolitan simulation models should also be mentioned. The Lowry model, developed at the Pittsburgh Regional Economic Study and completed at the RAND Corporation, and the University of North Carolina model are two of the most successful of these efforts [1] [2] [17]. These academic modeling efforts have both been strongly influenced by and in turn have influenced the models developed by comprehensive transportation studies. For example, the Lowry model is calibrated largely on travel and land use data obtained from the the Pittsburgh Area Transportation Study and a modified version of the model has been developed for use in the Bay Area Transportation Study.

3. *Community Renewal Programming (CRP) Models.* Over 160 communities have participated in Community Renewal Programs and have developed a programming model of some kind. However, computer and simulation methods have thus far had much less impact on Community Renewal Programming. Thus, only two CRP's, for Pittsburgh and San Francisco, are sufficiently well reported in the literature and involve "explicit" enough modeling to be considered in this survey [16] [23] [24].

4. *Regional Economic Models Developed for Use in River Basin Studies.* The Susquehanna river basin study is among the most advanced of this class [7] [18].

To meet space and time requirements, we will focus most of our discussion on metropolitan growth models and community renewal programming (CRP) models, and particularly the former. Both seek to explain or project the intraregional distribution of activity and should

be highly complementary to one another. Metropolitan growth models focus on the metropolitan periphery and primarily attempt to explain the extensive (marginal) growth of metropolitan regions; CRP models focus on central city real estate markets and primarily attempt to explain the demand for housing in built-up, relatively old and centrally located areas.

III. *Metropolitan Growth Models: Problems and Deficiencies*

Despite very great strides, metropolitan or intraregional growth models remain seriously deficient in at least three important dimensions: in modeling (1) industry (employment) location, (2) the housing market, and (3) the effects of housing market segregation. Not surprisingly, these three areas are also among the most difficult and most intractable areas of urban analysis, especially from an empirical standpoint.

In the broadest sense, the usual purpose of metropolitan growth models is to predict changes in metropolitan spatial structure and the location of residential and nonresidential activity within the region. Virtually all models postulate a recursive structure in which certain "basic" or nonpopulation serving employers choose locations within the region. These choices in turn become inputs into the location decision of employees of these firms, who, *ceteris paribus*, are assumed to live as near work as possible. So-called "linked" employment activities behave as the households since their costs or revenues, by definition, are favorably influenced by proximity to the basic employers. These location decisions by households and linked employers in turn influence or determine the location of population serving employment within the region.[1] While there may be important differences in the way in which models treat these linkages, all metropolitan growth models have a structure of this general kind. Sketching this causal mechanism serves to point up the critical function of basic employment in metropolitan growth models. Relatively small shifts in the location of metropolitan employment will cause pronounced differences in the location and density of linked employment, households, and population serving employment.

Given the "critical" nature of basic employment in these models, it is difficult to understand why so little research has been done on the determinants of industry location. It cannot be because these activities have been "stable" or because there have been no important shifts in the

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[1] These "basic" or nonpopulation serving industries are generally handled exogenously. In the Lowry model [17], for example, exogenous employment accounted for 361,000 jobs, while the endogenous population serving sector accounted for 191,000 jobs. The Lowry model determined the location of 191,000 population serving jobs and 470,000 households, given a predetermined distribution of the 361,000 basic or nonpopulation serving jobs.

underlying distributions. Though the data leave much to be desired, they leave no doubt that there have been major changes in industry location within U.S. metropolitan areas. Between 1954 and 1958 manufacturing employment declined in the central cities of thirty of the forty largest metropolitan areas [15]. The decline amounted to nearly 1.7 percent per year. During the period 1958–63 manufacturing employment declined in twenty-eight of these same forty SMSA's. During the period 1954–58 suburban manufacturing employment increased by 7.4 percent per year. Similarly, wholesaling employment, much of which could be included in the basic category, declined in twenty-one of the central cities of the largest metropolitan areas between 1958 and 1963.

Little effort thus has been made to explain the existing pattern of industry location. Even less attention has been devoted to explaining changes in this pattern. Most studies hypothesize a high degree of stability: existing basic employment activities (especially large ones) are presumed to remain at their existing locations (although possibly expanding somewhat). Heavy reliance on cross-section data and the *ad hoc* methods of projecting employment changes used in metropolitan growth models have biased these models toward underestimating the amount of change in existing distributions of employment and overestimating employment levels in built-up areas, particularly dense central areas. Forecasting errors of this kind can have, among other consequences, an enormous and erroneous effect on capital investment choices in transportation.

This bias toward overestimating employment levels within central areas is symptomatic of a more general shortcoming of metropolitan growth models. This is a failure to model, or even seriously contemplate, the adjustment processes by which the stock of residential and non-residential structures is adapted to new uses over time. Metropolitan growth models have concentrated on explaining or projecting the determinants of housing demand and particularly on projecting the extent and density of new residential development. Thus, they have all but ignored the determinants of supply or the manner in which the housing stock adjusts to changes in demand. Yet questions of stock adjustment are obviously central to any analysis of housing markets or to the design of programs to modify the characteristics of the housing supply. New construction accounts for only a fraction of the supply during any time period and tends to be sharply limited in its location. Despite the importance of stock adjustment and adaptation in metropolitan housing markets, almost no research exists on the way in which units are modified, upgraded, and downgraded.

It would be expected that CRP studies would have been more con-

cerned with these questions. However, they also focus on the demand for housing and virtually ignore supply relationships. Thus, we have virtually no idea how expenditures for maintenance and renovation vary by type of property and by type of household. While the meager research does not permit us to be very specific about changes in the housing stock, we do know something about the magnitude of this activity. Census data indicate that over four million dwelling units were upgraded from substandard to standard condition, while nearly one million went from standard to substandard between 1950 and 1959 [5, p. 156]. Similarly, expenditures for residential upkeep and improvement during 1965 were an estimated $11.4 billion of which $4.7 billion were for additions and alterations and $5.0 billion for maintenance and repairs. This compares with the $21 billion spent during that year on new housing units [25, p. 715]. It is clear that adequate structural modeling of metropolitan growth and development requires a more explicit treatment of the process of investment, disinvestment, and modification of the housing stock. Until some better understanding of these processes is obtained and, more ambitiously, some modeling of these changes is executed, metropolitan growth models will be next to worthless as either predictive or analytical devices for built-up areas. These deficiencies are even more serious where the models are intended as guides to government housing policy.

Nearly all metropolitan growth models are also color blind. While the impact of housing market segregation on metropolitan development is not adequately understood, there can be no doubt that its effects are substantial [13] [14]. The rapid growth of Negro ghettos in metropolitan areas creates a massive entrapped demand for low-quality housing within the ghetto. The ghetto's growth similarly displaces a large number of low-, middle-, and high-income whites that might otherwise locate in central cities. The result is a much different pattern of housing demand by income groups than might exist in the absence of segregation; specifically, a much more homogeneous residential location pattern by income groups than might otherwise be expected.

IV. *Some Observations on Data Requirements and the Present State of the Art*

Any large-scale effort at computer simulation creates, of course, special data and information requirements, as well as a need to estimate particular behavioral parameters. Computer simulation models are demanding in their data input requirements. One common fallacy is to argue that these models are therefore beyond the present state of the art. Actually, large-scale models of this type, which systematically check economic and physical data against one another, can provide an

invaluable set of consistency checks on the accuracy and quality of data obtained from diverse sources. Such models also provide useful insights as to where data ignorance is likely to be most penalizing in terms of decision quality. Indeed, the development of such models is almost a necessary prerequisite to better specifying data requirements and information systems for public investment evaluations. The alternative, incidentally, of asking only the questions that can be answered directly by the available data often smacks of weak rationalization for avoiding the important or relevant questions.

This need for a better definition of objectives in data gathering is well illustrated by experience with urban transportation studies. Disproportionate shares of the budgets of these studies have been devoted to the collection and processing of huge quantities of cross-section data on urban travel and in making "assignments" to highway networks. By comparison, budget allocations for the development of metropolitan growth models, while increasing considerably in recent years, remain pitifully small. In part these allocations are a reflection of what study staffs regard as important. However, they are also the result of an inherent conservatism. Changes from the "standard" method require extensive justification (particularly to the Bureau of Public Roads and state highway agencies) and assurances (difficult to provide) that the results obtained from a new and untested method will be better than, or at least as good as, those obtained from the standard method. Obviously, the first step in providing the needed justifications is development of better models.

Standardization also has an impact on the kinds of data available. Data availability has, in turn, strongly influenced not only the modeling activities of transportation studies' research staffs but the research focus of academic researchers. Thus, because urban travel and household data have been plentiful (although there have been some annoying deficiencies), computer modeling activities have emphasized relationships between household characteristics and travel choices to the exclusion of analyses for which data are not so easily available; e.g., employment location and the behavior of the housing market. In short, lacking a good model to better illuminate data needs, data availability has become a major factor conditioning and perpetuating model designs, with all their inadequacies.

Lack of attention to important behavioral problems, such as industrial location, housing stock adaptation, and the effects of housing market segregation in metropolitan growth models and CRP studies can also be explained by their having taken place as part of rather specific policy planning projects. Far more progress would have been possible at the same cost if these efforts had been placed in a somewhat different

institutional structure. Transportation studies have been carried out in over 200 and CRP studies in over 160 metropolitan areas since World War II. Virtually all of the transportation studies developed some kind of a metropolitan growth model. Admittedly, in many instances these models were nothing more than crude, *ad hoc* projections. But in an ever increasing number of instances, somewhat more ambitious modeling efforts have been undertaken. At any rate, the amounts spent on model building in the aggregate have been large. But for any one project, they have tended to be too small to permit really significant gains in the state of the art. When significant advances were obtained they were frequently poorly reported (e.g., due to limited publication budgets) or withheld because of "proprietary interests." Progress would have been more rapid if even a small portion of the resources devoted to these many individual model building efforts had been pooled and used for much larger scale efforts in a few metropolitan regions.

The model building or research activities have also been expected to keep pace with the difficult time schedules of the project planners. This creates substantial tensions between the researchers (or model builders) and the project planners that sharply constrain the amount and kinds of development that can be undertaken. Invariably, both the research and the planning suffer. Anyone engaged in research appreciates the deleterious effects of unrealistic deadlines. A clearer distinction seems needed between project planning and research and, in particular, between the actual planning process and model development.

In sum, large-scale physio-economic models are admittedly not easy to build. Frustrations have been known to attend such efforts. The basic requirements are: (1) a good deal of specific engineering; (2) an advanced computer technology and capability; (3) experience with the design and empirical estimation of economic growth models; and (4) an ability to estimate behavioral parameters relating changes in economic and physical phenomena to changes in the socioeconomic system. Nevertheless, the approach is much too appealing and correct to be abandoned. The alternative of limping along with partial analytical techniques can "succeed" only by begging many relevant questions.

REFERENCES

1. F. Stuart Chapin, Jr., Thomas G. Donnelly, and Shirley F. Weiss, *A Probabilistic Model for Residential Growth* (Center for Urban and Regional Studies, Univ. of North Carolina, 1964).
2. ———, "A Model for Simulating Residential Development," *J. of the Amer. Inst. of Planners,* May, 1965, pp. 120–25.
3. Chicago Area Transportation Study, Vol. II, *Final Report* (Chicago, 1960).
4. Detroit Metropolitan Area Traffic Study, Part II, *Future Traffic and a Long Range Expressway Plan* (Detroit, 1956).
5. Bernard J. Frieden, "Housing and National Urban Goals: Old Policies and New Realities," in *The Metropolitan Enigma,* ed. James Q. Wilson (Chamber of Commerce of the United States, 1967).

6. Charles H. Graves, *Forecasting the Distribution of 1985 Population and Employment to Analysis Zones for Plan A*, Staff Report No. 15 (Puget Sound Regional Transportation Study, Aug., 1964).

7. H. R. Hamilton, *et al.*, *Final Report on a Dynamic Model of the Susquehanna River Basin* (Battelle Mem. Inst., Columbus, Ohio, Aug. 1, 1966).

8. Britton Harris, "Linear Programming and the Projection of Land Uses," Penn-Jersey Transportation Study, PJ Paper No. 20, Nov., 1962.

9. James M. Henderson and Anne O. Krueger, *National Growth and Economic Change in the Upper Midwest* (Univ. of Minnesota Press, 1965).

10. Donald M. Hill, "A Growth Allocation Model for the Boston Region," *J. of the Amer. Inst. of Planners*, May, 1965, pp. 111–20.

11. Edgar M. Hoover and Raymond Vernon, *Anatomy of a Metropolis* (Harvard Univ. Press, 1959).

12. John F. Kain and John R. Meyer, *A First Approximation to a RAND Model for Study of Urban Transportation* (RAND Corp., Memorandum RM-2978-FF, Nov., 1961).

13. John F. Kain, "The Big Cities' Big Problem," *Challenge*, Sept.–Oct., 1966, pp. 5–8.

14. John F. Kain and Joseph J. Persky, "Alternatives to the Gilded Ghetto," paper prepared for the Economic Development Administration Research Conference in Washington, D.C., Feb., 1968. Also available as Discussion Paper No. 21, Program on Regional and Urban Economics, Harvard Univ. (Sept., 1967).

15. John F. Kain, "Distribution and Movement of Jobs and Industry," in *The Metropolitan Enigma*, ed. James Q. Wilson (Chamber of Commerce of the United States, 1967).

16. Arthur D. Little, Inc., *Model of the San Francisco Housing Market*, Technical Paper No. 8 (San Francisco Community Renewal Program, Jan., 1966).

17. Ira S. Lowry, *A Model of Metropolis* (RAND Corp., Memorandum RM-4035-RC, Aug., 1964).

18. Arthur Maass, *et al.*, *Design of Water-Resource Systems* (Harvard Univ. Press, 1962).

19. Penn-Jersey Transportation Study, Vol. 2, *1975 Projections, Foreground of the Future* (Philadelphia, Sept., 1964).

20. Pittsburgh Area Transportation Study, Vol. 2, *Forecasts and Plans* (Pittsburgh, 1963).

21. Pittsburgh Regional Planning Association, *Region with a Future, Economic Study of the Pittsburgh Region*, Vol. 3 (Univ. of Pittsburgh Press, 1963).

22. Paul O. Roberts, David Kresge, and John R. Meyer (eds.), *Techniques of Transport Planning*, Vol. II, *Models for Transport System Simulation* (Brookings Institution, forthcoming). Also see, Paul O. Roberts and David Kresge, "Simulation of Transport Policy Alternatives for Colombia," these *Proceedings*.

23. Ira M. Robinson, Harry B. Wolfe, and Robert L. Barringer, "A Simulation Model for Renewal Programming," *J. of the Amer. Inst. of Planners*, May, 1965, pp. 126–33.

24. Wilbur A. Steger, "The Pittsburgh Urban Renewal Simulation Model," *J. of the Amer. Inst. of Planners*, May, 1965, pp. 144–49.

25. U. S. Bureau of the Census, *Statistical Abstract of the United States: 1967*, 88th Ed. (Washington, D. C., 1967).

26. Raymond Vernon, *Metropolis 1985* (Harvard Univ. Press, 1960).

DISCUSSION

FRANK W. PUFFER: Professor Borts has presented a very interesting and provocative paper. This extension of neoclassical growth theory into the area of regional models presents me with a large number of possible areas for discussion. First, I am very pleased to see a confrontation of the analytic results with some data. This is a procedure that has many obvious advantages in that we are able to keep the elegant generality of the analytic result without offending the pragmatic empiricist who wants to see something that works with real data. In fact, the paper may be looked at in part as a partial answer of some criticism Professor Hirsch had of an earlier paper by Borts. Much of the data used in Borts's present paper was originally estimated for a paper given by him at the 1961 Conference on the Behavior of Income Shares. Professor Hirsch was a discussant of the paper and raised the point that some of the behavior of the data, both over time and cross-sectionally, seemed quite peculiar—peculiar in the sense that a number of alternative simple economic hypotheses did not fit the data very well. It is generally true that a good statistical fit tends to validate the data used to test the model as well as the model itself. Therefore, the reported result of a significant correlation between the observed D/Z values and the theoretically predicted ones tends to support the data as well as the model by showing that there is at least one reasonable economic theory that makes sense out of the data. As I understand the empirical results, however, the comparison between actual and predicted values was done only for 1953 and leaves unexplained the sometimes large changes over time that take place in the D/Z ratio by state.

Looking at the structure of the model itself, I have two questions to raise, both of which would not need mentioning if Borts had taken the easier route of avoiding a test with data. The first has to do with the derivation of the rate of change of D. In moving from equation (1) to equation (2), it is assumed that the only factor changing D is the income generated by the current balance of payments. This neglects two possible additional sources of change that may be of importance empirically. The first is the effect of changes in the interest rate from one period to another; the second is changes in the value of the portfolio of external assets. It is unlikely that such changes would be directly proportional to the current balance of payments so that an adjustment in the value of r would probably not be sufficient to take account of them.

The second question is concerned with the omission of net government borrowings. An important reason for this, of course, was the lack of proper data to test a model incorporating government borrowing, and I am quite sympathetic to that type of problem as must be anyone working in regional

economics. Nevertheless, there has been quite a bit of interest in the role the relative distribution of government spending and taxes by state has on comparative state economic behavior. It would therefore be interesting to explicitly include net government borrowing in the model even though data may not be available. First, it might shed some light on the mechanism by which government borrowing interacts with private borrowing and, second, it would remove some doubt concerning the generality of conclusions that always accompanies a partial economic model. The added analytic complexity may preclude this refinement for the time being, but it appears to be worthwhile.

Turning to the statistical results, we find that about 40 percent of the variation in the actual values of D/Z is explained by the hypothetical estimates of D/Z. Since the value of the parameter a is derived from the same data used to generate D/Z, there is the chance of compensating errors in both numbers although this possibility seems remote. Another more serious potential source of trouble becomes apparent looking at equation (10.) The value of r is assumed to be the same for all states and is chosen to be a value such that there is a reasonable distribution of debtor and creditor states. It does not appear that the correlation between the actual and hypothetical D/Z's would be affected much by small changes in the level of r, so I find no fault with the procedure used to estimate an average r. Instead I am concerned with the possibility that r may vary from state to state enough to influence the correlation obtained. There is some evidence that suggests regional variations in r may exist. A simple example is found in mortgage rates which may be 20–25 percent higher in Los Angeles than Boston. A theoretical case can be made for the assumption that r is correlated positively with k, the rate of growth of gross domestic product. In a high-growth rate area, a relatively high level of investment is needed and there is no reason to suppose there is necessarily a high propensity to save. Investment will then tend to exceed savings and we have a tendency toward net borrowing. Given imperfections in the capital markets, particularly a tendency to restrict loans geographically, and a variation of proportion of different financial institutions by state, it seems likely that the high-growth rate states would tend to pay a higher interest rate.

If this correlation exists, there is possibly an overstatement of the correlation between the actual and hypothetical D/Z's. A positive correlation between r and k would tend to reduce the variance of the numerator of the expression for D/Z and may not proportionately reduce the variance due to misspecification and errors of measurement. If so, this would result in a larger proportion of the variance of the hypothetical D/Z's being random or meaningless and thus lower the correlation between the actual and hypothetical ratios. Even if the explanatory fraction of the variance is not reduced, the overall variance of the hypothetical D/Z's would be reduced, changing the slope of the regression equation between the actual and hypothetical values. As a test of the theory it would be desirable to have both a high correlation and a slope of $+1$ between actual and hypothetical. Therefore, this reduction of variance may or may not be good for the validity of

the model, depending on whether the currently estimated hypothetical ratios have a larger or smaller variance than the actuals. However, if r is independent of the other parameters, it is likely that the correlation of the actual and hypothetical D/Z's would be improved.

The problems of actually measuring r by state, even if a proper definition of what that would mean could be agreed upon, would be most formidable; so their omission is no reason for criticism.

I have not dwelt upon the more positive aspects of the paper, since for the most part they speak for themselves. Given the assumptions of the model, most flow directly.

We are indebted to Professor Borts for presenting such an interesting paper.

SIDNEY SONENBLUM: There are two kinds of questions the Hirsch paper raised in my mind. First, if you decide to use input-output techniques for public policy analysis, then how should you do it? Second, and more interesting, is the question of whether you should want to use input-output techniques for public policy analysis?

Werner Hirsch's paper assumes that the answer to the second question is yes. I might parenthetically add that Werner Hirsch personally, as distinct from his paper, has some doubts about whether this answer is unequivocal.

Let us approach my first question by direct reference to the Hirsch paper. He proposes two possible applications of input-ouput techniques: to project (over say a 3–5 year interval) expenditures on specific urban services; to determine appropriate public policy if net fiscal health of the urban government is to be maximized.

In the projection model the following observations are made:

It is better to place the urban service as a processing sector within the endogenous part of a conventional input-output table. The advantage of this is that both the direct and indirect demands for specific goods and services which are generated by the urban service can be calculated. But more important, the direct and indirect demands for the public service which are generated by business activity and final demand can be calculated and need not be stipulated from the outside. It is recognized by Hirsch that demand for a public service is often determined by its supply—where the supply depends on "nonmodel" factors such as political pressures, budget constraints, etc. However, it is assumed by Hirsch that these nonmodel factors can be introduced by allowing input coefficients for the public service row to remain the same over time if no quality improvements in the service are provided, or if history shows that quality improvements are occurring, then these row coefficients can be extrapolated.

Now this last assumption has reasonable validity if two conditions are met. First is the usual kind of condition in an input-output table that there are no economies or diseconomies of scale in materials and services required in the urban service production process. In an urban service context this means that the services are horizontally integrated, which is undoubtedly true of many urban services. The second condition is that specific urban services be aggregated in a fashion which essentially meets the requirement

of a constant or predictable input coefficient. I think Hirsch is correct in emphasizing demand rather than technological characteristics as a criteria for aggregation, and I suspect that the five-sector classification he offers reasonably meets the conditions which have been outlined.

So far I have no quarrel. He has made arbitrary assumptions but they are reasonable. I might quibble over some points but only to substitute a different kind of arbitrariness. For example, the demand for the urban service is calculated as independent of the sources of financing; i.e., whether it is paid for by user charges, local government raised revenues, grants-in-aid, or even possibly direct state expenditures to provide the service. In the conventional input-output table this kind of issue is not significant since the customer pays and his payments determine the demand. But even assuming that we are not interested in sources of financing because of their effect on demand, we are still interested in financing questions for public policy analysis. The Hirsch framework throws no light on this question even though it could possibly be expanded to do so.

Now we come to the implementation of the model for projection purposes. Here I must read between the lines because Hirsch's illustration does not relate to projections but rather to historical estimating. He suggests that, for the historical year, control totals for each urban service sector be estimated; then that the row allocation of the total be determined on the basis of various kinds of assumptions. No problem yet. We have ended up, in effect, with urban service input coefficients to each of the processing and final demand sectors. Now comes the projection. Something happens in the community, so that final demand and output for each industry changes and we calculate the new demands for the urban service. But, supposing the something that happens in the community is that it is decided to change the quality of the urban service. The mayor decides to pick up the garbage twice a day rather than once. Here, it seems to me, we are substantially involved in stipulating the projected urban service output rather than deriving the projection from the I-O demand calculations. It doesn't matter whether we stipulate the quality change or use some other device; it remains the case that our assumption about quality change is critical. Conceivably, the change in quality can have as large an effect upon the urban service output as the change in output or income of the demanding sectors. Therefore, the question arises in my mind of where we should put our research energies. Is it not plausible to say that changing industry mix will have only a small effect on urban service demands? Therefore might we not ignore the industry mix problem and relate the urban service output to some aggregate index of activity in the community—say, total income or population or employment? This aggregative approach would then compel us to seek out the causes of quality change rather than hide behind some assumption about an input coefficient. In other words, when projecting education expenditures we would worry more about projecting the per student expenditure ratio and worry less about how the change in the number of students is affected by changes in industrial composition.

The answer to this kind of rhetorical question about what kind of research

we "should" do in making projections is in the last analysis dependent on what the data show about which factors the urban service expenditures are sensitive to. But it provides me with a circuitous way of getting at a point; namely, it is my hunch that if you are already working with an input-output structure to make projections of various kinds of activities in a community, then you would be well advised to use this structure to project urban services—in something like the way Hirsch describes. But if your only purpose is to project urban services, then you would be well advised to stay away from the development and implementation of an input-output table. Sonenblum Cost-Benefit Rule No. 1: If you have an input-output table, then use it where possible; but if you don't have one, then unless you have a variety of purposes to serve, don't make one up.

Now we come to the Hirsch planning model. While the Hirsch projection model is pretty straightforward, his planning model is quite ingenious in the way it uses input-output information. This last statement deserves emphasis. Hirsch is not describing how an input-output model can be used as a programmed planning instrument. He is describing how input-output information can be used, along with other information, to assist in planning.

Unlike in the projection model, the urban service sector is not an endogenous processing sector in the planning model. Rather an input-output table is constructed which yields industry output and regional income multipliers. Some impact occurs which affects final demand so that output and income can then be calculated. At this point the work begins. For example, given the resulting income, side calculations are made to get a family income distribution in order to obtain income tax estimates; side calculations are made to determine the kinds of household expenditures consistent with the regional income estimates and thus sales taxes can be calculated; or, the weakest part of the model's revenue calculations, a series of dubious side calculations are made to yield the property tax payments by each industry and household sector.

Similar side calculations are required to obtain urban service expenditures. The magnitude and composition of population and property are identified as the factors affecting the demand for urban services. The I-O calculations provide industry output and community income estimates and then through side calculations these factors are used as the basis for determining population and property changes which in turn are used to calculate the related urban expenditures. Finally, to arrive at the assumed event's effects on net fiscal health, the urban expenditures and revenues need only to be compared.

My only critical observation about the planning model is to generalize a remark which Hirsch makes about the property tax; namely, that the measuring of the effects of some event on each of the revenue and expenditure estimates through side calculations is "superior to direct estimation from the input-output matrix." This provides the basis for Sonenblum's Cost-Benefit Rule No. 2: If the side calculations are more extensive than the model calculations, then forget the model and concentrate on the side calculations.

I will summarize my remarks by answering the second question I initially raised as to whether input-output techniques should be used for public policy analysis. If input-output data are available, by all means use them; it probably won't do too much harm. But if it is going to cost to develop input-output data, then be sure that a variety of issues are going to be analyzed so that overhead can be spread and research costs per unit of answer are kept low.

INVITED STUDENT DISSERTATIONS
TERMS OF TRADE AND ECONOMIC DEVELOPMENT: A CASE STUDY OF INDIA*

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This paper attempts to ascertain the movement of India's long-run terms of trade through the construction of unit-value index numbers and to investigate possible domestic consequences of the movement of these external prices. The importance of such a study is evident in view of the fact that, with regard to underdeveloped countries, the existing literature on the terms of trade is characterized by overgeneralized statements, by conflicting conclusions with respect to the historical movement of this variable, and by a paucity of attempts to indicate possible internal consequences of such movements. Especially with regard to the long-run trend, many economists have contended that one of the major difficulties faced by these countries in their growth efforts is the secular terms of trade deterioration [7] [15] [17] [20]. This "deterioration hypothesis," however, has recently been challenged by several writers [3] [5] [6] [8] [9] [10] because of deficiencies in the statistical support (i.e., "inversion" of the British terms of trade) initially given for the hypothesis. Nevertheless, the fact remains that the deterioration hypothesis has seldom been tested other than from indirect evidence using advanced countries' data. More conclusive tests for underdeveloped countries require the direct calculation of the terms of trade with their own statistics. To date, only a few such studies have been made [9] [10]. In view of the many policy suggestions which have emerged from the deterioration hypothesis, it is desirable to carry this research further.

Terms of Trade Calculations

Commodity Terms of Trade. India was selected as the focus for this study for a number of reasons, the major ones being the availability of reliable data and the fact that the country historically experienced

significant economic interrelations with the advanced nations. The only extensive similar work previously done for India is that of Morgan [9, pp. 8–10, 15–16, 22], but, for reasons spelled out subsequently, it is necessary to construct a more useful and consistent series.

The period covered in the calculations below extends from the (Indian fiscal) year 1903–04 through 1952–53. These dates were selected because of the desire to cover a reasonably long-run period, the desire to employ a "relatively normal" starting point, and statistical convenience. Since, from the author's point of view, it seemed necessary to calculate both of the common price indexes—Laspeyres (base-year weights) and Paasche (given-year weights)—a base year also needed to be chosen. The year chosen was the relatively normal one of 1923–24; however, as noted below, the choice was a rather unimportant one, since a shifting of the base to 1903–04 reveals substantially the same results.

Once these choices were made, the remaining preliminary task was the selection of commodities to be included in the calculations. Since unit-values were to be calculated,[1] all of the exports and imports in 1923–24 for which both value and volume figures could be obtained were selected. The resulting sample contained 47 export classifications and 43 import classifications. The 47 exports accounted for an annual average of 92.2 percent of private merchandise exports over the period, the figure being above 90 percent in every year through 1936–37 but falling to an annual average of 84.4 percent thereafter. The 43 imports were less comprehensive in coverage, the annual average being 59.3 percent for the fifty-year period. This figure was 72.2 percent for the first decade but fell rather steadily to 43.9 percent for the last ten-year period. This latter decline reflected diversification of imports and the growing importance of capital goods imports (for which volume figures could not be obtained). However, the computed indexes hopefully serve as reasonable approximations to the total import price behavior.

Having concluded the summary discussion of procedure, the results for the export and import price indexes are shown in Table 1. The resulting commodity terms of trade indexes are then plotted in Figure 1. Table 2 presents a general summary statement of the behavior of the various indexes, with the total fifty-year interval being divided into five relatively clearly delineated periods. An indication is also given of the particular commodities which seemed to be the most influential in the price index movements.[2]

[1] These external data are preferable because internal prices include distortions from tariffs, subsidies, controls, etc. See [9, p. 9] and [7, p. 16].

[2] Several procedural remarks need to be made relating to the summarized calculations. First, the commodity classifications in the data sources [19] became more precise after 1929–30, so a linking procedure was introduced in nine previous commodity categories to take account of this more complete breakdown. Second, when Burma was separated in 1937, the trade accounts now referred to a different geographical area than previously. Data on Indo-Burmese

TABLE 1

EXPORT AND IMPORT PRICE INDEXES, 1903–04—1952–53
(1923–24 = 100)

Year	Laspeyres Export Index	Laspeyres Import Index	Paasche Export Index	Paasche Import Index
1903–04	50.5	48.5	49.8	44.0
1904–05	50.2	50.3	50.4	45.6
1905–06	52.5	49.1	52.9	44.1
1906–07	58.1	51.6	58.2	46.0
1907–08	58.3	55.1	56.9	49.6
1908–09	56.1	53.4	54.6	50.3
1909–10	55.9	51.9	55.7	48.3
1910–11	62.4	55.2	62.0	51.0
1911–12	64.4	56.5	66.5	52.3
1912–13	66.5	58.9	68.9	52.2
1913–14	69.0	59.7	69.4	53.9
1914–15	62.3	58.6	61.4	53.3
1915–16	65.0	66.2	66.2	59.1
1916–17	75.2	87.8	76.7	75.9
1917–18	82.5	114.0	83.1	94.3
1918–19	106.0	142.9	103.2	121.0
1919–20	108.2	131.9	108.2	128.3
1920–21	98.8	149.7	98.5	149.9
1921–22	94.1	118.6	89.4	116.0
1922–23	95.7	100.9	95.4	99.5
1923–24	100.0	100.0	100.0	100.0
1924–25	108.1	96.5	108.3	96.1
1925–26	106.4	88.6	105.0	86.9
1926–27	95.0	81.8	94.2	79.6
1927–28	94.6	76.2	95.4	74.1
1928–29	93.5	75.0	91.9	74.5
1929–30	87.8	72.8	84.5	71.2
1930–31	67.3	62.5	65.8	58.8
1931–32	55.4	56.0	56.1	53.6
1932–33	54.8	51.9	52.8	49.1
1933–34	52.3	50.0	50.0	48.3
1934–35	51.4	51.3	50.2	49.5
1935–36	53.4	49.3	53.0	48.4
1936–37	53.7	51.5	52.4	52.1
1937–38	58.8	60.8	56.7	60.8
1938–39	54.0	56.1	51.8	56.1
1939–40	64.3	59.3	60.6	59.7
1940–41	66.2	73.5	64.1	71.1
1941–42	77.8	92.0	81.6	89.0
1942–43	88.6	146.4	100.2	106.3
1943–44	119.2	169.2	125.3	130.6
1944–45	128.2	186.2	129.8	161.2
1945–46	133.0	293.3	124.4	146.8
1946–47	141.9	298.2	146.6	141.2
1947–48	192.6	340.1	195.1	159.9
1948–49	220.3	355.7	228.2	225.6
1949–50	218.3	303.2	234.0	224.8
1950–51	277.5	383.8	253.8	211.5
1951–52	424.1	521.7	385.7	263.6
1952–53	263.2	463.9	264.0	237.9
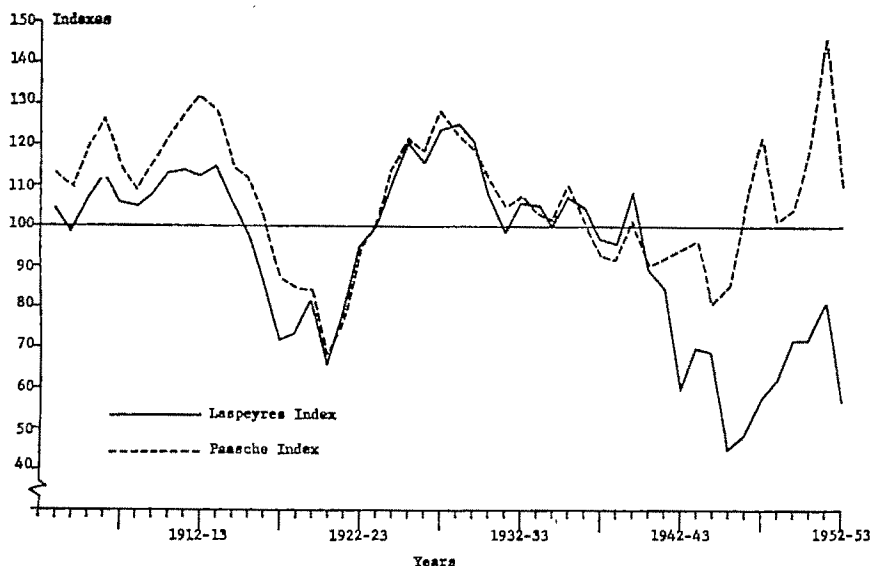
FIGURE 1

LASPEYRES AND PAASCHE COMMODITY TERMS OF TRADE (1923–24 = 100)

In looking over the entire 1903–04—1952–53 period, some conclusions can be suggested. The major conclusion is that, over the long run, India's terms of trade did not deteriorate to any marked extent, although the later years of the period are rather inconclusive in this respect. A further conclusion is that there have been definite, rather long periods of fluctuation but that, contrary to a frequently-voiced expectation regarding primary producing countries [6, p. 289], India's terms of trade did not deteriorate during depression periods (e.g., the 1930's) nor did periods of unusual price increases (the two wartime periods) necessarily improve them.[3] The most favorable situation seemed to be one of mild prosperity, as in 1904–14 and during the 1920's. (Both the conclusion regarding trend and the conclusion regard-

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trade at the level of disaggregation necessary were not available, and an adjustment to link the 1936–37 and 1937–38 price indexes has not been made. This is presumably not serious, for it is difficult to see why unit-values would be affected. The Paasche (only) weights might be affected, but Indian export shares were largely unchanged between the two years while, in imports, the main change (mineral oils) could not have affected the indexes in a manner which would alter any of the later conclusions of this paper. Third, these comments relating to the Burma separation apply also to Partition of India and Pakistan in 1947. The primary changes in Indian commodity shares immediately after Partition were: in exports, an increase in jute manufactures at the expense of raw cotton; and, in imports, an increase in foodgrains at the expense of mineral oils. It is difficult to tell to what extent these shifts were due to Partition. At any rate, the post-1947 period is not heavily relied upon in the subsequent analysis.

[3] However, India did not fit the typical primary-producer category, since primary imports and manufactured exports were often of importance.

TABLE 2

SUMMARY STATEMENT OF TERMS OF TRADE RESULTS

Period	Export (X) and Import (M) Price Trends	Terms of Trade Trend	Leading Commodities Influencing the Indexes
(1) 1903–04–1913–14	X: slight increase M: slight increase	slight improvement	X: raw cotton, raw jute, seeds M: cotton manufactures
(2) 1914–15–1920–21	X: moderate increase M: substantial increase	substantial deterioration	X: raw hides & skins, raw cotton, raw wool, seeds, jute manufactures M: brass, copper, tobacco, iron and steel
(3) 1921–22–1928–29	X: relative stability M: moderate decrease	moderate improvement	X: price increases in raw jute & jute manufactures, price decreases in raw cotton, lac, cotton twist and yarn, cotton manufactures M: relative uniformity in all commodities
(4) 1929–30–1939–40	X: slight decrease M: slight decrease	relative stability	X: raw cotton, rice, jute manufactures M: cotton manufactures, raw sugar
(5) 1940–41–1952–53	X: substantial increase M: substantial increase	*Laspeyres*: substantial deterioration followed by partial recovery *Paasche*: slight deterioration, more than offset by succeeding substantial improvement	X: jute manufactures, raw jute, seeds, raw hides & skins M: iron and steel, tobacco, automobiles, raw cotton, sugar, cotton and jute manufactures

ing fluctuation remained unchanged when the base year was shifted to 1903–04.)

In addition to these conclusions, however, another important point emerges. The constructed series above permit the formation of tentative judgments on the responsiveness of the Indian economy to movements in its foreign trade price relations. A priori, the fact that the Paasche import price index is virtually always below the Laspeyres index after the base year[4] intuitively implies that, as prices rose for particular heavily-weighted base year commodities, the composition of trade changed so as to give these commodities less relative importance in the index. (Conversely, commodities with smaller relative price increases began to be imported in larger quantities.) The natural exten-

[4] This kind of statistical result does not always follow from the mere nature of the Laspeyres and Paasche formulas. See [11, p. 35].

sion of the consumption response is that domestic production may also have responded to meet consumption demands now thrown upon the home market. In the export indexes, one would expect a Paasche index above the Laspeyres index if a similar response is to be detected. The evidence here is rather weak, but, in exports, the two indexes were always close together and commodity shares changed only slightly. Nevertheless, the "expected" divergence occurs rather regularly after 1940–41. These points concerning internal responsiveness seem crucial for any integration of terms of trade behavior with internal development and are examined in more detail below.[5]

Income Terms of Trade. A remaining task before the investigation of the internal responsiveness, however, is the calculation of the so-called "income" terms of trade. The results of the computations are given in Figure 2. These three series were obtained by calculating a value index for total exports (adjusted for the separations of Burma and Pakistan) and then dividing this index respectively by the constructed Laspeyres and Paasche import price indexes and also by the Fisher "ideal" index. The pattern parallels closely the commodity terms of trade, but general observation suggests that the fluctuations of the income terms were greater and that a declining trend was much more certain after 1939–40. This latter result reflects the sluggishness of export quantities in relation to import prices and is in clear opposition to Morgan's speculation (without evidence) that the income terms are apt to show a more favorable trend for underdeveloped regions than are the commodity terms of trade [9, p. 20].

Tests for Internal Responsiveness

Having completed the presentation of the terms of trade results, the focus of this paper now turns to what must of necessity be a brief summary of the attempt made to discern the possible responsiveness of domestic production to foreign trade price movements. Due to time and resource limitations, the study was confined to output responses in import-competing industries; i.e., the export side was omitted—a decision which can be defended on the grounds that the Laspeyres-Paasche

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[5] These considerations could not be made, of course, without the initial construction of the various Laspeyres and Paasche indexes. In addition, in order to relate the movements to internal variables as is done below, uniform and consistent figures are needed over a fairly long-run period. It is for these reasons that the above constructions have been performed, despite the fact that Theodore Morgan has earlier done path-breaking work on the Indian terms of trade [9, pp. 9–10, 15–16, 22]. Morgan gathered several available price series together for various-length periods, but the major deficiencies of the series are: use of domestic prices in general rather than actual trade unit-values; identification of primary products prices alone as export price indicators and manufactured goods prices as import indicators; and the use of relatively small samples in some cases. Only one relatively short series utilized direct export and import data, and this series corresponded relatively closely only to the Paasche index of this paper. For extensive discussion, see [1, pp. 40–48].
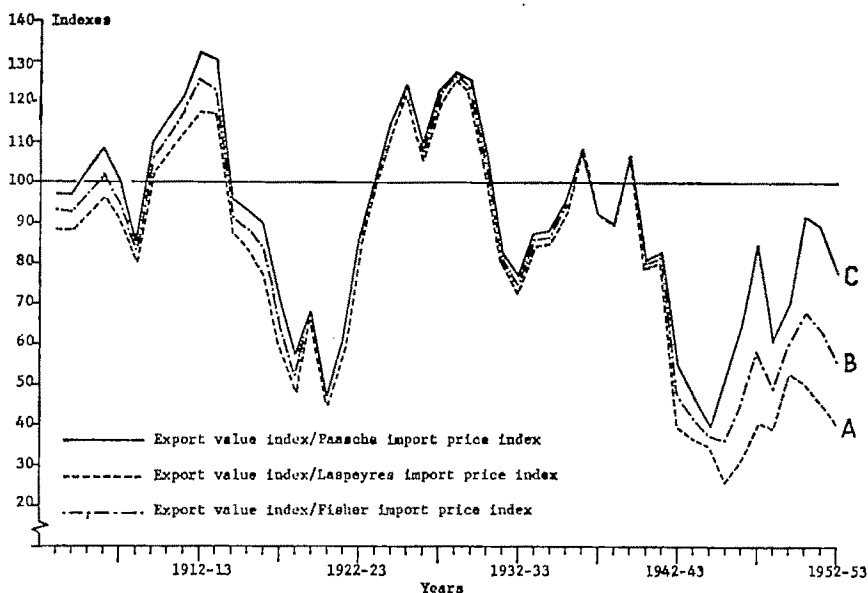
FIGURE 2

INCOME TERMS OF TRADE (1923-24 = 100)

divergence was greater on the import side. The sample consisted of
ten commodities for which production indexes could be pieced together.
These ten commodities were of major importance in the import struc-
ture, however, and accounted for 81 percent of the imports by value of
the 43-commodity sample used above. The testing procedure and
results are given below with a division being made into "nonagricul-
tural" commodities (six commodities) and "agricultural" commodities
(four commodities).

Nonagricultural Commodities. The basic framework for testing for the
effect of import prices on domestic output of the nonagricultural com-
modities is obtained by viewing the market for a given domestically-
produced good in a relatively simple demand-supply context. In linear
form, the specification is

(1) $$Q_d = a_1 + a_2 P_m + a_3 P_d + a_4 Y,$$

(2) $$Q_s = b_1 + b_2 P_d + b_3 C,$$

and, assuming that no inventory changes take place,

(3) $$Q_d = Q_s = Q_p,$$

where

Q_d= quantity demanded of the domestically-produced good—assumed to be at least slightly differentiated from the imported product,

Q_s= quantity supplied of the domestically produced good,

P_m= import price,

P_d= domestic price,

Y= real national income,

C= an index of costs, and

Q_p= quantity produced.

In order to test for the impact of import price upon domestic output, solving for the reduced form in Q_p is sufficient. Since the reduced form requires that Q_p be dependent only upon exogenous variables, P_d must be eliminated. This requires solving for P_d in (2) and substituting the result into (1). This yields an expression which can be rewritten with simplification as

(4) $Q_p = c_1 + c_2 P_m + c_3 C + c_4 Y.$

This formulation gives an expectation that c_2 will be positive, c_3 negative, and c_4 positive. In the actual regressions below, another term $c_5 P_y$ has been added to the testing equation, with P_y being a general price index used to modify the partial equilibrium analysis and to reflect possibilities of substitution. The sign of c_5 cannot be determined a priori.

Within the framework of the estimating equation, any positive effect in c_2 could be viewed in a straightforward manner: a shortage develops, for example, of an imported commodity, leading to a higher import price; demand for the domestically-produced version of the product then increases; and domestic output responds to this stimulus, unless the short-run supply elasticity is zero. Further, if the expansion of the domestic industry results in the absorption of previously unemployed and/or underemployed resources, the increment in output can be regarded as an offset to the adverse welfare implications of rising import prices of particular commodities.

It remains to describe the nature and sources of the data employed in the regression analysis. The import prices are, of course, those calculated above, modified to include tariff charges. This adjustment was necessary in order to represent the internal market situation facing the producers in a given industry. The domestic prices and domestic output series come from a variety of sources, including the *Statistical Abstracts of India* and the work of Narain [13], Narasimham [14], Sastry [16], and Sivasubramonian [18]. For the national income variable, three different series have been used in the regressions, derived from [2] [12] [14], the third covering only 1919–52. The general price index used was that provided by Arora and Iyengar [2, p. 214]. For the cost indexes,

TABLE 3

REGRESSION RESULTS FOR NONAGRICULTURAL COMMODITIES

Commodity	Coefficients*				
	c_2	c_3	c_4	c_5	R^2
Cotton manufactures...... (50 years)	+ .0543 (.0608)	− .6104 (.2637)	+2.9713 (.1749)	+.1497 (.2228)	.93
Cotton yarn.............. (50 years)	+ .1233 (.0623)	− .8080 (.2774)	+1.7656 (.1868)	+.1439 (.1879)	.82
Wool manufactures........ (21 years)	− .2625 (.4535)	+.9386 (.5160)	−1.4069 (3.5308)	− .2858 (1.3598)	.34
Ale, beer, and porter....... (48 years)	+1.7876 (.2848)	− .1972 (.1369)	+1.4797 (.5998)	− .4612 (.2915)	.81
Petroleum................ (20 years)	+ .2904 (.1412)	− .1262 (.1274)	+1.3692 (.5720)	+.1063 (.2017)	.68
Iron and Steel............ (34 years)	+ .2098 (.1621)	+.2127 (.4984)	+6.6967 (.5698)	− .8577 (.5343)	.92

* The standard errors of the estimates are given in the parentheses below the coefficients.

price series were derived for what might be regarded as the "leading input" in the productive process.

The "best" results of the estimated regressions with respect to the import price variable are presented in Table 3. However, these results are disappointing from the standpoint of internal responsiveness within the basic testing model employed. Only in one of the six commodities (the alcoholic beverages[6]) is there a statistically significant (.05 level) coefficient for the import price variable. On the other hand, the income variable is clearly significant (with the exception of wool manufactures, a commodity category which presented substantial data problems). Thus, although some support might possibly be given to the hypothesis of responsiveness to import price movements, it is unfortunately not as strong as was initially expected.

Agricultural Commodities. The remaining commodities to be discussed are the agricultural commodities: raw cotton, raw sugar, raw tobacco, and foodgrains. A different testing equation was used here, however, because a time lag of one year was specified between price and output movements on the supply side. In linear form, the functions are:

$$(5) \qquad Q_d = a_1 + a_2 P_m + a_3 P_d + a_4 Y + a_5 P_y,$$

$$(6) \qquad Q_s = b_1 + b_2 P_{d-1} + b_3 C + b_4 P_{s-1},$$

$$(7) \qquad Q_d = Q_s = Q_p,$$

[6] A trend variable t was introduced into the regressions for this commodity because of the steady decline in production throughout the period.

where Q_d, Q_s, Q_p, P_m, P_d, Y, and P_y are defined as above and where

  P_{d-1} = domestic price in the previous period,
  C = agricultural wage rate, and
  P_{s-1} = price of a production substitute in the previous period.

The simplified reduced form of the model used for estimation purposes is

$$(8) \quad \begin{aligned} Q_p = c_1 + c_2 P_{m-1} + c_3 P_{d-2} + c_4 C_{-1} + c_5 C + c_6 Y_{-1} \\ + c_7 P_{y-1} + c_8 P_{s-2} + c_9 P_{s-1}, \end{aligned}$$

with positive signs expected for c_2, c_4, c_6, c_7, and c_8 and negative signs for c_3, c_5, and c_9.[7]

The basic output data employed were derived from the work of Blyn [4]. The import price, income, and general price index sources were those employed above in the nonagricultural commodities. The wage index used was the field labor series given by Narasimham [14], supplemented by a series derived from the *Statistical Abstracts*. The remaining price indexes were those contained in Narain [13], Sivasubramonian [18], and the *Statistical Abstracts*. The production substitute selected for cotton was jowar, while Narain's index of agricultural prices was used for sugar, tobacco, and foodgrains.

Presentation of all the resulting coefficients is not undertaken here, since the c_2 coefficient is the only one of present interest. The results are summarized in Table 4. Only one of the import price coefficients is significantly positive (raw tobacco). With respect to the other variables, virtually every coefficient possessed the expected sign, although these were not often statistically significant. In summary of the results here, it can be said that there was some possible support for the hypothesis, but that the data and estimation problems preclude positive judgments with respect to these commodities. Looking at the regressions for both the nonagricultural and agricultural commodities as a whole, however, it must be stated that there was less internal responsiveness to import price movements than had initially been expected. This could, of course, be a consequence of improper specification of the model or simply of the fact that India's foreign trade sector is relatively small.

Macroeconomic Comparisons. The remainder of the dissertation under review consisted of preliminary explorations of potential relationships between terms of trade movements and macroeconomic variables in order to focus on possible sympathetic cyclical movements. Simple correlations and graphical comparisons were made for the following relationships: commodity terms of trade and national income; income terms of trade and national income; and income terms of trade and investment.

[7] Expression (8) was obtained by solving for P_d in (5), substituting the result with the variables lagged into (6), and then solving for Q_p.

TABLE 4

IMPORT PRICE COEFFICIENTS FOR AGRICULTURAL COMMODITIES

Commodity	Import Price Coefficient*	R^2
Raw cotton............ (50 years)	+.0116 (.1284)	.55
Raw sugar............. (46 years)	+.0616 (.1055)	.76
Raw tobacco........... (40 years)	+.1265 (.0515)	.65
Foodgrains............ (27 years)	+.1526 (.0795)	.53

* The standard errors of the estimates are given in the parentheses below the coefficients.

The trend was removed from the income and investment series for these cyclical comparisons. While the correlations were all positive, the only correlation above 0.4 was the very high 0.95 obtained between the income terms of trade and Narasimham's series on "investment activity" [14] between 1922–23 and 1935–36. In general, the income terms of trade were more highly correlated with income and investment than were the commodity terms of trade, but the preliminary nature of the comparisons and the possible unreliability of the macroeconomic data preclude overall positive judgments on the basis of the terms of trade-income-investment comparisons.

Summary and Conclusions

In summary, the trend of the commodity terms of trade was one of relative constancy, although the changing relative weights (especially on the import side) made for some uncertainty after 1940–41. The cyclical variations were also of interest since deterioration was associated with periods of price rise while constancy was present during the depression of the 1930's. Finally, the relatively stagnant export earnings in conjunction with rapidly increasing import prices in the later years gave the result that the income terms of trade deteriorated markedly after 1939–40.

An important byproduct (the Laspeyres-Paasche systematic divergence) of the these calculations provided the stimulus for investigation into potential internal responsiveness to import price variations. However, the results on the industry-by-industry basis generally gave only limited support to the hypothesis. Within the testing framework employed, only the income variable was usually of significance. This suggests that the growing market as reflected in the national income figures apparently provided an important stimulus to output expan-

sion. Finally, the study compared terms of trade movements with aggregate investment and income movements. The results of these latter comparisons suggested that perhaps the income terms of trade are at least of equal importance to the commodity terms of trade in considerations of development policy and prospects. However, the failure of the testing framework to uncover consistently significant impacts of foreign sector prices on domestic activity suggests that, in general, Indian development policies should be mainly concerned with internal growth problems rather than with the terms of trade per se.

REFERENCES

1. D. R. Appleyard, "Terms of Trade and Economic Development: A Case Study of India" (unpublished Ph.D. dissertation, Univ. of Michigan, 1966).
2. H. C. Arora and K. R. R. Iyengar, "Long Term Growth of National Income in India, 1901–1956," in *Papers on National Income and Allied Topics*, Vol. I, ed. V. K. R. V. Rao, S. R. Sen, M. V. Divatia, and Uma Datta (New York, 1960).
3. R. E. Baldwin, "Secular Movements in the Terms of Trade," *A.E.R.*, May, 1955, pp. 259–69.
4. G. Blyn, "Agricultural Trends in India, 1891–1947: Output, Welfare, and Productivity" (unpublished Ph.D. dissertation, Univ. of Pennsylvania, 1961).
5. P. T. Ellsworth, "The Terms of Trade Between Primary Producing and Industrial Countries," *Inter-American Economic Affairs*, Summer, 1955, pp. 61–77.
6. G. Haberler, "Terms of Trade and Economic Development," in *Economic Development for Latin America*, ed. H. S. Ellis (New York, 1961).
7. C. P. Kindleberger, *The Terms of Trade: A European Case Study* (New York, 1956).
8. G. M. Meier, *International Trade and Development* (New York, 1963).
9. T. Morgan, "The Long Run Terms of Trade Between Agriculture and Manufacturing," *Economic Development and Cultural Change*, Oct., 1959, pp. 1–23.
10. ———, "Trends in Terms of Trade, and their Repercussions on Primary Producers," in *International Trade Theory in a Developing World*, ed. R. F. Harrod and D. Hague (London, 1963).
11. B. D. Mudgett, *Index Numbers* (New York, 1951).
12. K. Mukerji, "A Note on the Long Term Growth of National Income in India," in *Papers on National Income and Allied Topics*, Vol. II, ed. V. K. R. V. Rao, A. K. Ghosh, M. V. Divatia, and Uma Datta (Bombay, 1962).
13. D. Narain, *Impact of Price Movements on Areas under Selected Crops in India, 1900–1939* (London, 1965).
14. N. V. A. Narasimham, *A Short Term Planning Model for India* (Amsterdam, 1956).
15. R. Prebisch, "Commercial Policy in the Underdeveloped Countries," *A.E.R.*, May, 1959, pp. 251–73.
16. N. S. R. Sastry, *A Statistical Study of India's Industrial Development* (Bombay, 1947).
17. H. W. Singer, "The Distribution of Gains Between Investing and Borrowing Countries," *A. E. R.*, May, 1950, pp. 473–85.
18. S. Sivasubramonian, "Estimates of Gross Value of Output of Agriculture for Undivided India, 1900–01 to 1946–47," in *Papers on National Income and Allied Topics*, Vol. I., ed. V. K. R. V. Rao, S. R. Sen, M. V. Divatia, and Uma Datta (New York, 1960).
19. *Statistical Abstracts of India*, various issues.
20. United Nations, Economic Commission for Latin America, *The Economic Development of Latin America and its Principal Problems* (Lake Success, New York, 1949).

EFFECTS OF TAX POLICY ON INVESTMENT
IN MANUFACTURING*

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Tax incentives for investment have been in vogue in the United States since 1954 when firms were granted the opportunity to accelerate depreciation for tax purposes through use of the declining balance and sum-of-years-digits depreciation methods. More recently, firms have benefited from the 7 percent investment tax credit (3 percent for utilities) incorporated in the Revenue Act of 1962, the reductions in equipment lives for tax purposes permitted under the Treasury Department's Revenue Procedure 62-21 (released in July, 1962), and the tax rate reductions provided by the Revenue Act of 1964. The purposes of this study are (1) to determine the magnitude of the tax savings that manufacturing firms have enjoyed as a result of these policies and (2) to determine the impact of tax incentives on plant and equipment expenditures in manufacturing.

Tax incentives are thought to stimulate capital expenditures in two ways. First, by reducing the amount of taxes that must be paid on income from assets, or by changing the timing of the tax payments in favor of the future, tax incentives increase the after-tax rate of return on capital. Second, by reducing tax liabilities, tax incentives increase a firm's cash flow (after-tax profits plus depreciation charges for tax purposes), which is one measure of internal funds available for investment and is thought by some to be an important determinant of investment expenditures. The rate-of-return effect is captured here in a "user cost of capital" variable, i.e., an implicit rental price of capital, which enters the investment function as a determinant of the demand for capital. The internal-funds effect is captured by the inclusion of cash flow in the investment function as a determinant of the speed at which firms eliminate any gap between their desired and actual stocks of capital.[1] This seems to be the appropriate way of entering cash flow

[1] Pioneering studies of capital stock adjustment models in which economic variables influence the adjustment speed are those of Greenberg [3] and Hochman [5]. A theoretical rationale for such models has been developed by Eisner and Strotz [2].

in the investment relation, since short-term financial considerations should primarily affect the timing of expenditures, not the desired stock of capital.

I. *Tax Incentives and Cash Flow*

Cash flow during period t can be written as

$$(1) \qquad F_t = (1 - u_t)(R_t - D_t) + D_t + C_t,$$

where u is the tax rate on business income, R is gross business income (gross of depreciation, but net of all other deductions), D is depreciation charges for tax purposes, and C is the amount of the investment credit. Suppose that if tax policy changes had not occurred relative to some selected base period, the tax rate faced by firms would have been u^*, their depreciation charges for tax purposes would have been D^*, and they would not have been permitted an investment credit. Thus, in the absence of the policy changes, cash flow would have been

$$(2) \qquad F_t^* = (1 - u_t^*)(R_t - D_t^*) + D_t^*,$$

and tax savings resulting from the policy changes are

$$(3) \quad F_t - F_t^* = \overbrace{(u_t^* - u_t)(R_t - D_t^*)}^{\substack{\text{Savings due to tax}\\\text{rate change only}}} + \overbrace{u_t^*(D_t - D_t^*)}^{\substack{\text{Savings due to}\\\text{accelerated de-}\\\text{preciation only}}} - \overbrace{(u_t^* - u_t)(D_t - D_t^*)}^{\text{Interaction term}} + \overbrace{C_t}^{\substack{\text{Savings due}\\\text{to tax credit}}}.$$

Estimates of F-F^* and its components for corporate manufacturing are presented in Table 1. As an approximation, the interaction between tax rate changes and depreciation accounting changes is distributed in proportion to the separate effects. The tax structure selected as the base is that prevailing at the end of 1953. The major computational task underlying these figures is estimation of the series D^*. This series was obtained by applying a straight-line depreciation formula to gross investment expenditures in manufacturing, assuming a useful life for tax purposes of 25 years for acquisitions through 1945 and 18 years for postwar acquisitions. These tax lives were suggested by studies of corporate income and balance-sheet data carried out by Huntley [6] and Hickman [4], and they were found to work reasonably well in the sense that the series obtained approximated actual depreciation charges in the earlier postwar years quite closely, as it should.

Tax savings resulting from the 1954 acceleration of depreciation peaked in 1955 at \$816 million, then tapered off to \$382 million in 1961.[2] The new depreciation guidelines gave depreciation charges an-

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[2] This statement is not quite correct. Actual depreciation charges, D, include accelerated amortization of emergency facilities; $D-D^*$ therefore reflects not only the depreciation ac-

TABLE 1

TAX SAVINGS RESULTING FROM TAX INCENTIVES
ALL CORPORATE MANUFACTURING, 1954–66
(Millions of dollars)

Year	Tax Savings				Equivalent Rate Reduction			
	Accl. Deprec.	Tax Credit	Tax Cut	Total	Accl. Deprec.	Tax Credit	Tax Cut	Total
1954	559			559	.028			.028
1955	816			816	.029			.029
1956	797			797	.030			.030
1957	781			781	.031			.031
1958	699			699	.035			.035
1959	592			592	.022			.022
1960	462			462	.020			.020
1961	382			382	.017			.017
1962	927	421		1,348	.035	.014		.049
1963	840	573		1,413	.029	.018		.047
1964	933	680	648	2,261	.028	.021	.020	.069
1965	1,155	819	1,540	3,514	.029	.021	.039	.089
1966*	977	731	1,271	2,979	.030	.022	.039	.091

* First three quarters only.

other shot in the arm and, with aid from the tax credit, boosted tax savings in 1962 to $1,348 million. The tax cuts of 1964 and 1965 made for continued growth in tax savings—to a level of $3,514 million in 1965. Perhaps more interesting and more meaningful than the absolute savings are the "equivalent rate reductions" shown in Table 1. These figures indicate the reduction in the tax rate on corporate income that would have produced tax savings equal to those brought about by tax incentives. Thus, by 1966 the entire bundle of tax incentives was equivalent to a reduction of 9.1 percentage points (from 52 to 42.9 percent) in the corporate income tax rate. Accelerated depreciation and the investment tax credit alone amounted to a 5.2 percentage point reduction—an indication of the extent to which these policies have eroded the corporate income tax.

II. Tax Incentives and the User Cost of Capital

Suppose that a competitive firm is contemplating increasing its capital stock by one (small) unit, that a unit of capital costs q dollars, and that capital deteriorates at a rate δ per period. The firm will have to make an initial outlay of q dollars and will have to increase replacement expenditures in each future period by $q\delta$. Output in each period will be increased by the marginal product of capital, $\partial Q / \partial K$; and if each addi-

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counting changes introduced in 1954 but also accelerated amortization. Excluding amortization from D would make sense only if amortized acquisitions could be eliminated from the expenditure series used to calculate D^*, but it was not possible to obtain the data needed to make this adjustment.

tional unit of output can be sold at a price p, gross revenue in each period will be increased by $p(\partial Q/\partial K)$. Net revenue, however, will be increased by only $p(\partial Q/\partial K) - q\delta - T_i$, where T_i is the increase in direct taxes that must be paid in period i. Suppose for the moment that there is no tax credit. Defining D_i as the increase in depreciation charges for tax purposes in period i, we have $T_i = u(p\partial Q/\partial K - D_i)$.[3] The firm should add one unit to its capital stock if the discounted value of the increases in net revenue exceeds the price of a unit of capital; that is, if

$$(4) \quad \sum_{i=1}^{\infty} \left[(1-u)p\frac{\partial Q}{\partial K} - q\delta + uD_i \right](1+r)^{-i} = \left[(1-u)p\frac{\partial Q}{\partial K} - q\delta \right]\frac{1}{r}$$
$$+ u\sum_{i=1}^{\infty} D_i(1+r)^{-i} > q,$$

where r is the interest rate at which the firm may borrow or lend in any amount.

Let d_i be the amount of tax depreciation permitted on an investment of one dollar i periods after the investment has been made (the d's may, of course, be zero after some point), and let $B = \sum_{i=1}^{\infty} d_i(1+r)^{-i}$, i.e., B is the discounted value of depreciation charges stemming from a current dollar of capital expenditures. Then

$$(5) \quad \sum_{i=1}^{\infty} D_i(1+r)^{-i} = qB + q\delta B \sum_{i=1}^{\infty}(1+r)^{-i} = qB + q\delta B\frac{1}{r}.$$

Hence, the firm should add one unit to its capital stock if

$$(6) \quad (1-u)p\frac{\partial Q}{\partial K} - q\delta + ruqB + uq\delta B > rq,$$

that is, if

$$(7) \quad p\frac{\partial Q}{\partial K} > q(r+\delta)(1-uB)/(1-u) = c.$$

The expression, c, on the right-hand side of the inequality is referred to as user cost; it is the implicit rental price per period of a unit of capital.[4]

[3] The deductibility of interest payments is ignored here, primarily because of the unsolved conceptual and analytical problems it raises concerning the manner in which expenditures are financed and the appropriate measure of the cost of funds.

[4] A user cost expression similar to the one obtained here was first derived by Jorgenson [7], but his formulation was not an appropriate one for studying depreciation policy in the United States, as I showed in a paper entitled, "Accelerated Depreciation, the Investment Tax Credit, and Investment Decisions," which I delivered at the December, 1965, meetings of the Econometric Society. His user cost measure is correct only for the special case in which (a) the depreciation formula is of the declining balance form with a depreciation rate equal to δ and (b) policy-makers stipulate that the depreciable base of acquisitions is a proportion v of their cost. If policy-makers were to change v, they would not change the timing of depreciation charges, but rather the total amount of the write-off.

The firm should continue to expand its capital stock until the marginal product of capital is equal to the real price of capital, c/p.

If there were no direct tax, user cost would be $q(r+\delta)$. A direct tax with no depreciation allowance increases user cost by the factor $1/(1-u)$; a depreciation allowance reduces user cost by the factor $1-uB$, uB being the discounted value of the tax savings generated by the depreciation allowance. If firms were permitted to expense capital goods, B would be unity and the existence of the direct tax would not alter user cost.

This analysis can easily be extended to include an investment credit. If a proportion s of capital outlays can be credited against tax liabilities, and if the depreciable base of acquisitions must be reduced by a factor b if the credit is taken, then

$$(8) \qquad c = q(r + \delta)[1 - s - u(1 - b)B]/(1 - u).$$

The investment credit enacted in 1962 required that $b=s$; that is, the depreciable base of acquisitions had to be reduced by the amount of the credit—a provision that somewhat blunted the effect of the credit. The Revenue Act of 1964 did away with this requirement, so that beginning in 1964, $b=0$.

Estimates of the user cost of capital in manufacturing are presented in Table 2. The GNP implicit price deflator for nonresidential fixed investment was used as an estimate of q, with a 1954 = 100 base. Jorgenson's [7] estimate of the replacement rate for all manufacturing was adopted as an estimate of δ,[5] Moody's industrial bond yield was used as an estimate of r,[6] and general statutory corporate income tax rates were used for u. The fraction of the value of acquisitions permitted as a credit (s) was taken to be .029 for 1962, which was the ratio of the credit in corporate manufacturing to manufacturing investment in 1962, and .037 for 1963–66, which was the ratio of the credit to investment in 1963, the last year for which I had information. Two variants of B were calculated. The first employed the straight-line depreciation formula and made no allowance for the reduction in useful lives in 1962. The second variant employed the double-rate declining balance depreciation formula beginning in 1954 and in mid-1962 reduced the

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[5] The estimated value of δ was .0271 per quarter, which implies that a unit of capital loses about 85 percent of its real value in 18 years.

[6] Choosing an appropriate measure of "the interest rate" raises many problems regarding the definition and measurement of the cost of funds to firms. Miller and Modigliani [8] have discussed and solved many of these problems. They have found that for the electric utility industry the AAA bond yield is far superior to a weighted average yield on bonds and equities in predicting both the level of, and magnitude of changes in, the cost of funds. Whether or not this is also true in the manufacturing sector is unknown, since research in this important area is just beginning. I have decided to proceed as if it were true. I did experiment with other assumptions regarding the cost of funds and found that the results were not very sensitive to this choice.

TABLE 2

CONSISTENT STRAIGHT-LINE USER COST AND ACTUAL USER COST, 1947–66

| Year | User Cost | | Equivalent Tax Rate Reduction |
	Consistent Straight-line	Actual	
1947	11.60	11.60	
1948	12.98	12.98	
1949	13.17	13.17	
1950	13.62	13.62	
1951	16.01	16.01	
1952	16.83	16.83	
1953	17.76	17.76	
1954	17.47	16.84	.049
1955	18.08	17.42	.049
1956	20.04	19.26	.049
1957	22.81	21.85	.047
1958	22.94	21.99	.048
1959	24.93	23.83	.047
1960	25.24	24.12	.047
1961	25.23	24.11	.047
1962*	25.28	24.16	.048
1962†	25.16	22.67	.122
1963	25.22	22.54	.134
1964	25.80	22.14	.194
1965	26.40	22.35	.214
1966‡	28.64	24.12	.202

* Average of first two quarters expressed at annual rates.
† Average of last two quarters expressed at annual rates.
‡ Average of first three quarters expressed at annual rates.

useful life for tax purposes from 18 years to 15 years, which seems to be a reasonable estimate of the reduction brought about by the new guidelines. Thus, the 1954 depreciation acceleration is characterized here as a switch from the straight-line to the double-rate declining balance depreciation formula.[7]

"Consistent straight-line user cost" in Table 2 gives estimates of what user cost would have been after 1953 had no tax incentives been enacted during the period—that is to say, it is based on the straight-line depreciation formula; the tax life of assets is held constant at 18 years; the tax rate is held constant at 52 percent; and no allowance is made for the tax credit. "Actual user cost" incorporates all tax incen-

[7] This is not an inconsequential assumption. In my dissertation I have also carried out the calculations on the assumption that the 1954 depreciation acceleration was a shift from the straight-line to the sum-of-years-digits formula. While the fit of the investment relations is the same, the sum-of-years-digits variant yields considerably higher estimates of the effects of tax policy. I feel, however, that the declining-balance variant is the relevant one for two reasons. First, it is more popular than sum-of-years-digits. Second, businessmen were slow in adopting rapid write-offs (see Ture's evidence on this [9]), which means that declining-balance, having a lower discounted value, probably approximates actual experience more closely.

tives enacted during the period. A word should be said about the units in which user cost is measured. Consider, for example, the 1954 consistent straight-line figure, 17.47. This indicates that the implicit rental cost in 1954 of a unit of capital selling for $100 was $17.47 per year. The unit of measurement is not indicated in the heading of the table because user cost is just an index number.

The last column of Table 2 presents estimates of tax rate reductions that would have yielded reductions in user cost equal to those actually brought about by tax incentives. The results are certainly striking. For example, it would have taken roughly a 20 percentage point reduction in the tax rate (from 52 to 32 percent) to bring about as large a reduction in user cost as that produced by the entire bundle of tax incentives! It is also interesting to examine the period from 1962 through 1966 more closely to assess the relative importance of various tax incentives in reducing user cost. Precise calculations would be tedious and difficult because of the many interaction effects. Rough calculations show that the new guidelines accounted for about 63 percent of the reductions in 1962 and 1963, the remaining 37 percent being attributable to the investment credit. As a result of the 1964 tax rate reduction, the increase in the equivalent tax rate reduction should have been about 2 percentage points in 1964, but the actual increase was of the order of 6 percentage points, which indicates the substantial impact of the 1964 change in the tax credit provision.

III. *The Investment Function*

Two specifications of the investment function were used in investigating the importance of tax incentives. The first is a capital stock adjustment model with a constant adjustment speed, i.e.,

Model 1: $I_t = \beta(K^*_t - K_{t-1}) + \delta K_{t-1},$

where I is gross investment, β is the adjustment rate, K^* is the desired capital stock, and K_{t-1} is the actual capital stock at the end of period $t-1$. The parameter δ is the replacement rate and is assumed throughout to be equal to Jorgenson's estimate mentioned above. The second specification introduces cash flow as a determinant of the adjustment speed and can be written as

Model 2: $I_t = \left[\beta_1 + \beta_2 \dfrac{F_{t-1}}{K^*_t - (1-\delta)K_{t-1}} \right] [K^*_t - (1-\delta)K_{t-1}].$

The expression $K^*_t - (1-\delta)K_{t-1}$ is the amount of gross investment needed during period t to attain the stock K^*_t by the end of the period; it is what might be called the investment chore. Model 2 is based on the

notion that it is the level of internal funds relative to the investment chore that in part determines the adjustment speed.

Substituting for K_t its definition in terms of past investments, namely, $K_t = \sum_{i=0}^{\infty} (1-\delta)^i I_{t-i}$, and subtracting $(1-\delta)I_{t-1}$ from both sides of the relations, we obtain

$$(9) \qquad I_t = \beta[K^*_t - (1-\delta)K^*_{t-1}] + (1-\beta)I_{t-1}$$

and

$$(10) \quad I_t = \beta_1[K^*_t - (1-\delta)K^*_{t-1}] + (1-\beta_1)(1-\delta)I_{t-1}$$
$$+ \beta_2[F_{t-1} - (1-\delta)F_{t-2}].$$

A cost minimization hypothesis underlies the specification of the determinants of K^*. Because of substantial lags between placement of orders and final shipments, current and future demand for output is best reflected by new orders in most manufacturing industries. Given a projection of demand, a firm will minimize the costs of producing the associated level of output by equating the marginal rate of substitution between capital and labor to the ratio of their prices. Hence, the demand for capital depends on new orders and on the ratio of the user cost of capital to the wage rate. Actual values of new orders and factor prices are likely to contain both transitory and permanent elements. It is assumed that firms base their decisions on the permanent components and that the permanent components can be approximated by a weighted average of current and past values of the variables. The weighting scheme that produced the best results for each variable was a 12-quarter inverted-V distribution.[8]

Let X_t and c_t' denote the permanent components of new orders and relative factor prices (c/w, where w is the wage rate) for period t. Then

$$(11) \qquad K^*_t = \alpha_0 + \alpha_1 X_t + \alpha_2 c_t'$$

and

$$(12) \qquad K^*_t - (1-\delta)K^*_t = \delta\alpha_0 + \alpha_1\Delta X_t + \alpha_2\Delta c_t',$$

where $\Delta X_t = X_t - (1-\delta)X_{t-1}$, etc. Substituting (12) into (9) and (10), we obtain the investment functions that were estimated:

Transformed Model 1: $I_t = \beta\delta\alpha_0 + \beta\alpha_1\Delta X_t + \beta\alpha_2\Delta c_t' + (1-\beta)I_{t-1}$,

and

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[8] This distribution was first suggested and successfully tested by DeLeeuw [1].

Transformed Model 2: $I_t = \beta_1 \delta \alpha_0 + \beta_1 \alpha_1 \Delta X_t + \beta_1 \alpha_2 \Delta c_t'$

$$+ (1 - \beta_1)(1 - \delta) I_{t-1} + \beta_2 \Delta F_{t-1},$$

where $\Delta F_{t-1} = F_{t-1} - (1 - \delta) F_{t-2}$. All structural parameters are identifiable from these transformed relations.

The estimated relations fitted to quarterly OBE-SEC investment data for manufacturing are presented in Table 3. Two $\bar{R}^2$'s (coefficients of multiple determination corrected for lost degrees of freedom) are presented for each relation, $\bar{R}^2_I$ measuring the relations ability to explain the level of investment and $\bar{R}^2_{\Delta I}$ measuring its ability to explain changes in investment. Because quarterly investment shows a very high first-order autocorrelation, the fit obtained by regressing I_t on I_{t-1} and anything else is bound to be quite high. The statistic $\bar{R}^2_{\Delta I}$ is, therefore, very useful in evaluating the relations.

The importance of the acceleration variable is confirmed in both models. The relation containing cash flow provides a much better fit to these data, and inclusion of cash flow greatly reduces the importance of the factor-price variable. Looking at the structural parameters derived from the regression coefficients, we find an adjustment speed for Model 1 of about 11 percent per quarter—a rather low figure in view of the fact that a long expectations lag is already imposed on the data. Model 2 gives a more reasonable result. If, for example, cash flow were about equal to the investment chore, the adjustment rate would be about 28 percent per quarter; but if cash flow were very small relative to the chore, the rate would be only 10 percent per quarter. Model 2 also provides a more reasonable estimate of E_{K^*X}, the elasticity of K^* with respect to X—.897 as opposed to .723 for Model 1. It should also be

TABLE 3

INVESTMENT REGRESSIONS AND STRUCTURAL PARAMETERS*
REGRESSION COEFFICIENTS AND t VALUES

Model	Constant Term	ΔX	$\Delta c'$	I_{-1}	ΔF_{-1}	$\bar{R}^2_I$	$\bar{R}^2_{\Delta I}$
1	.2529 (2.889)	.1014 (4.901)	−3.122 (−3.752)	.8892 (29.22)		.975	.460
2	.1125 (1.295)	.1211 (6.258)	−1.517 (−1.770)	.8804 (31.93)	.1802 (3.901)	.980	.560

Structural Parameters

Model	β	β_1	β_2	α_0	α_1	α_2	E_{K^*X}	$E_{K^*_0'}$
1	.1108			84.22	0.915	−28.18	.723	−.579
2		.0951	.1802	43.65	1.273	−15.95	.897	−.292

* 67 observations, 1950–1 through 1966–3.

TABLE 4

A. Increases in the Demand for Capital Resulting from Tax Policy Changes
(Millions of 1954 dollars)

Period	ΔK^*: Model 1	ΔK^*: Model 2
1954-1–1962-2	2,496	1,413
1962-3–1963-4	3,372	1,909
1964-1–1964-4	1,960	1,109
1965-1–1966-3	778	440
1954-1–1966-3	8,606	4,871

B. Investment Attributable to Tax Incentives
(Millions of 1954 dollars)

Year	Model 1	Model 2	Actual Investment
1954	103	72	11,065
1955	438	271	11,113
1956	624	340	13,690
1957	575	296	13,870
1958	551	268	9,790
1959	495	228	9,972
1960	455	198	11,928
1961	420	179	11,253
1962	377	262	11,954
1963	692	422	12,673
1964	1,295	704	14,848
1965	1,650	882	17,663
1966*	1,287	689	15,476
Sum:54-1—62-2	3,842	1,965	98,518
Sum:62-3—66-3	5,120	2,846	66,777

* First three quarters only.

noted that both models give much smaller elasticities for factor prices than for output; $E_{K}*_{c'}$ is $-.579$ for Model 1 and only $-.292$ for Model 2.

IV. *Tax Incentives and Investment Expenditures*

According to the model developed in this study, a reduction in the user cost of capital will produce a one-shot increase in the desired stock of capital. The magnitude of the increase depends, of course, on the substitutability of capital and labor. Net investment expenditures will be increased for a number of periods, until the new desired stock of capital is attained, and replacement investment will be permanently increased, its new stationary value being $\delta \Delta K^*$ larger than its previous stationary value, where ΔK^* is the increase in the desired stock.

Table 4, Part A, presents estimates of the increases in the desired capital stock in manufacturing brought about by tax incentives. Part B gives annual estimates of the increases in gross investment expenditures

resulting from tax incentives. As expected, the estimates of ΔK^* from the two models differ markedly—$8.6 billion for Model 1 versus $4.9 billion for Model 2 over the period studied. The higher value would imply an increase in the stationary level of replacement expenditures of about $0.9 billion per year; the lower value would imply a $0.5 billion increase in replacement.

The estimates in Part B give some idea of the timing of expenditures generated by increases in the desired capital stock. The estimates for Model 2 take into account the influence of tax savings on the adjustment speed, but it seems that allowance for the cash flow effect is not enough to bring the predictions of the two models closer together. Model 1 gives larger estimates of the effects of tax incentives in terms of both capital stock and investment; it suggests that 5.4 percent of total investment expenditures from 1954 through the third quarter of 1966 was accounted for by tax incentives. Model 2 suggests that just 2.9 percent of total investment during this period can be attributed to tax incentives.

A decisive judgment on the effectiveness of tax incentives is impossible unless one is willing to pass judgment on the relative merits of the two investment models. As was noted above, Model 2 provides a superior fit to the data used here and also gives more reasonable estimates of the adjustment speed and the elasticity of capital stock with respect to output. For these reasons Model 2 should be preferred to Model 1, and it appears that the smaller estimates in Table 4 are the appropriate ones for evaluating tax incentives. They suggest that the performance of tax incentives has been disappointing. Policies that produced an estimated $5.1 billion (constant 1954 dollars) in tax savings in manufacturing from 1954 through mid-1962 increased manufacturing capital expenditures by only $2.0 billion during the same period, and policies that produced an estimated $8.6 billion in tax savings from mid-1962 through the third quarter of 1966 increased expenditures by only $2.8 billion. In terms of net additions to capital stock, which is perhaps a more sensible yardstick in view of the fact that under stationary conditions tax savings from accelerated depreciation would ultimately disappear (D would approach, but would never fall below, D^*) while gross investment would continue to be enlarged by the amount of replacement generated by the increase in the desired capital stock, $13.7 billion in tax savings produced only a $4.9 billion growth in capital stock.

REFERENCES

1. Frank deLeeuw, "The Demand for Capital Goods by Manufacturers: A Study of Quarterly Time Series," *Econometrica*, July, 1962, pp. 407–23.
2. Robert Eisner and Robert H. Strotz, "Determinants of Business Investment," *Impacts of Monetary Policy*, Research Study Number Two, prepared for the Commission on Money and Credit (Prentice-Hall, 1963).

3. Edward Greenberg, "A Stock-Adjustment Investment Model," *Econometrica*, July, 1964, pp. 339–57.
4. Bert G. Hickman, *Investment Demand and U. S. Economic Growth* (Brookings Institution, 1965).
5. Harold M. Hochman, "Some Aggregative Implications of Depreciation Acceleration," *Yale Econ. Essays*, Vol. 6, No. 1, 1966.
6. Patrick Huntley, "State Distribution of Manufacturers' Plant and Equipment in Place, 1954–56" (unpublished Ph.D. dissertation, Univ. of North Carolina, 1961).
7. Dale W. Jorgenson, "Capital Theory and Investment Behavior," *A.E.R.*, May, 1963, pp. 247–59.
8. Merton H. Miller and Franco Modigliani, "Some Estimates of the Cost of Capital to the Electric Utility Industry, 1954–57," *A.E.R.*, June, 1966, pp. 333–91.
9. Norman B. Ture, *Accelerated Depreciation in the United States, 1954–60*, National Bureau of Economic Research Fiscal Studies, No. 9 (Columbia Univ. Press, 1967).

ADJUSTMENT OF THE SIZE OF THE LABOR FORCE: AN ANALYSIS OF SELECTED LABOR MARKET AREAS IN THE UNITED STATES*

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The concept of the labor force is increasingly being utilized and investigated as a meaningful economic variable. Much of the decision making concerning the utilization of labor, both from the employer and employee standpoints, is made within the confines of a local labor market area. Accordingly the dependent variable in this study was the seasonally adjusted size of the labor force within major local labor market areas.

The overall objectives of this study were to investigate the flexibility of the labor force within the context of a number of major local labor markets and to evaluate the applicability of the use of distributed lag models in the appraisal of labor supply adjustments over time. The objectives of the econometric analysis were to focus on the explanation of variation in area labor force size over time as a function of variation in area job attractiveness and variation in area job availability, and to focus on the time required for the area labor force to respond to changes among the independent variables.

Migration studies attempt to explain the patterns of migration according to income differentials and job vacancy attractions [1] [4] [17]. Labor force participation studies attempt to explain variation in participation rates according to variations in income, the unemployment rate, and the employment-population ratio of the relevant group [2] [5] [14] [18] [19] [20]. This particular study used an area wage variable, an area job vacancy variable, and an area unemployment rate variable as measures of area job attractiveness and area job availability in·an attempt to explain variations in area labor force size. An innovation of this study was the substitution of a measure of unsatisfied labor demand (i.e., help-wanted advertising index) for measures of the satisfied demand for labor (i.e., employment, percentage change in employment, and the employment-population ratio). The latter variables have often been designated as proxy variables for job vacancies in the literature.

Because the major labor market area series, providing bimonthly estimates of area labor forces and area unemployment rates, was initi-

ated in the year 1960, this study covers the recent five-year period from January, 1960, through December, 1964 [22] [23] [24]. A single equation, nonlinear, distributed lag multiple regression model was formulated in order to test statistically specific hypotheses and to investigate the possibility of lags in local labor force adjustment.

Labor Market Theory

The traditional viewpoint is that the quantity of labor supplied is a function of the average wage rate and that labor mobility, induced by wage differentials, will reallocate the labor resource until equilibrium is achieved.

A less traditional view is that the labor market is simply a mechanism which distributes jobs. The quantity of labor supplied in the short run becomes a function not of wage rates but of available job opportunities. The link between wage determination and labor mobility as established by traditional economic theory is thus severed or weakened because of market imperfections and frictions within the labor market.

According to this argument there are market imperfections on both the demand and supply side of the labor market. On the demand side, wage differentials and wage changes are a result of institutional forces such as industry-wide union-employer bargaining and current government wage and price guidelines. On the supply side, the relative immobility of labor for reasons of lack of knowledge, fear, and uncertainty in movement, and inertia represents an important market friction. The labor mobility that does occur is not in response to wage differentials, for wage differentials need not signify that quantity adjustments are in order. Employers, in the short run, often do not (or cannot) adjust wage rates in order to attract additional labor [8].

What mobility does exist, especially from non-labor force to labor force status or vice versa, is a function of job opportunities, independent of the wage rate involved. Therefore it is hypothesized that, for a particular labor market area, short-run changes in labor force size are more dependent upon movements of an index of jobs available than upon movements of an index of an average wage.

The static area labor supply function is assumed to be an upward sloping function of the area mean wage rate, area job opportunities, and area job attributes. Area job attributes is a term which encompasses such factors as fringe benefits, working conditions, etc., and such factors will be assumed constant for a particular area. Each area will be investigated separately. Therefore the quantity of labor supplied (Y_t) per time period (t), as measured by the size of the area labor force, is dependent upon the area mean wage rate (W_t), area job opportunities (O_t), and an error term in the equation (Z_t). The error term is a sto-

chastic disturbance term which reflects the net effect of omitted variables.

Since the area mean wage rate is, to a degree, assumed to be insensitive to the local labor demand relative to labor supply conditions, the variable of area job opportunities is hypothesized as the more important in the explanation of variations in area labor force size. The variable of area job opportunities has two aspects. One aspect is the area job vacancy rate. This is the objective aspect of the job opportunity variable. The second aspect, subjective in nature, of this variable is that workers develop expectations concerning job opportunities. Individuals or groups of individuals that are members of the labor force or prospective members of the labor force establish expectations of being absorbed into employment within a reasonable period of time (assuming, of course, the individual is not presently employed). The expectations of the most mobile groups (all except the hard core employed males, age 25 to 65) are apt to be most affected by area job opportunities. This is one reason the area unemployment rate, an inverse index of area job opportunity, could be significant in explaining variations in area labor force size [3].

Model Formulation

Since the time element is such an important factor in the adjustment of labor supply to labor demand conditions, it is imperative that the model be dynamic. The statistical model used in this investigation is an autoregressive least squares distributed lag model containing two lag parameters. Current area labor force size is assumed to be a function, not only of the current value of the independent variables, but also of all past values of the independent variables. Two separate lag coefficients, lambda (λ) and mu (μ), are introduced into the model. Lambda (λ) will be associated with the past values of one set (i) of independent variables and mu (μ) with the past values of the second set (j) of independent variables. Each lag coefficient is assumed to decline exponentially through time and each varies between minus one and plus one; i.e., $-1 < \lambda, \mu < +1$.

The Koyck form of the distributed lag regression, assuming lag λ is associated with the independent variable(s) X_{it} and lag μ is associated with the independent variable(s) X_{jt}, is as follows:

$$(1) \qquad Y_t = a_0 + \sum_{i=1}^{A} \sum_{q=0}^{\infty} a_i \lambda^q X_{it-q} + \sum_{j=1}^{B} \sum_{q=0}^{\infty} b_j \mu^q X_{jt-q} + W_t$$

In order to reduce equation (1) into a form suitable for estimation it is necessary to proceed as follows [13]. First, lag equation (1) by one time period. Second, multiply the result of step one by λ. Third, subtract the result of the second step from equation (1). Fourth, lag the result of step three by one time period. Fifth, multiply the result of step four by

μ. Sixth, subtract the result of the fifth step from the result of step three. The result is equation (2).

(2) $$Y_t = a_0(1 - \lambda)(1 - \mu) + \sum_{i=1}^{A} a_i X_{it} - \mu \sum_{i=1}^{A} a_i X_{it-1}$$

$$+ \sum_{j=1}^{B} b_j X_{jt} - \lambda \sum_{j=1}^{B} b_j X_{jt-1} + (\lambda + \mu) Y_{t-1}$$

$$- \lambda\mu Y_{t-2} + U_t$$

where $U_t = W_t - (\lambda + \mu)W_{t-1} + \lambda\mu W_{t-2}$

Assume the errors of equation (2) follow a first order autoregressive pattern of:

$$U_t = \beta U_{t-1} + e_t \quad \text{where} \quad -1 < \beta < +1.$$

Lag equation (2) by one time period and then multiply this lagged equation by beta (β). Then subtract the result from equation (2). This procedure results in equation (3).

(3) $$Y_t = a_0(1 - \lambda)(1 - \mu)(1 - \beta) + \sum_{i=1}^{A} a_i X_{it}$$

$$- (\mu + \beta) \sum_{i=1}^{A} a_i X_{it-1} + \mu\beta \sum_{i=1}^{A} a_i X_{it-2}$$

$$+ \sum_{j=1}^{B} b_j X_{jt} - (\lambda + \beta) \sum_{j=1}^{B} b_j X_{jt-1}$$

$$+ \lambda\beta \sum_{j=1}^{B} b_j X_{jt-2} + (\lambda + \mu + \beta) Y_{t-1}$$

$$- [(\lambda + \mu)\beta + \lambda\mu] Y_{t-2} + \lambda\mu\beta Y_{t-3} + e_t$$

Equation (3) is the general form of the equation to be estimated.

Consistency and asymptotic normality are properties of the final estimates of the autoregressive least squares estimation procedure assuming (a) the X_{it} and X_{jt} are bounded and (b) the e_t are normally distributed. The estimates are also maximum likelihood estimates which are efficient if the likelihood function is unimodal.

An iterative estimation procedure has been utilized in order to obtain unique estimates of the unknown parameters.[1] The detailed estimation procedure is described by Fuller and Martin [6] [7], and by H. O. Hartley [9].

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[1] The actual estimation was accomplished at the Computer Center of Oklahoma State Univ. utilizing James E. Martin, *Computer Programs For Estimating Certain Classes of Non-linear Distributed Lag Models* (Misc. Publication No. 546, Department of Agriculture Economics; Univ. of Maryland, 1965), pp. 1–28.

The statistical t test was used in order to test whether the estimated parameters were statistically different from zero at various levels of confidence. The statistics obtained by the autoregressive least squares iterative procedure are only asymptotic estimates and therefore exact t and F tests cannot be performed [11].

Results

Twenty-two major metropolitan area labor markets were selected for this study. The dependent variable, the seasonally adjusted size of the area labor force (Y_t), represents the empirical measure of the quantity of labor supplied in a specified area for a specified time period. It was hypothesized that fluctuations in the quantity of labor supplied over time in a specified labor market area could be explained by fluctuations over time of the following independent variables: the area mean wage rate (X_{t1}) as measured by the average hourly earnings of production workers in manufacturing, area job opportunities as measured by (a) the area help-wanted advertising index (X_{t1}) and by (b) the seasonally adjusted unemployment rate of the specified area (X_{t2}). It was expected that the seasonally adjusted size of an area's labor force would be postively related to the wage variable and the help-wanted index variable while negatively related to the unemployment rate variable. Another expectation, based on the imperfect nature of an area labor market, was that the dependent variable responds with a significant lag to changes in the independent variables.

Table 1 presents the results of the initial regression analysis. There appeared to be relative independence between variation in the size of the area labor force and variation in the area wage rate. Significance was found between these two variables only in the labor market areas of Washington, D.C., and Salt Lake City. In both cases there did exist a positive relationship between the wage rate and labor supply variable. The dependent variable responded with a significant lag to changes in the area wage rate in both of these markets.

Variation in the seasonally adjusted help-wanted index was significantly related in a positive fashion to variations in the quantity of labor supplied in the labor markets of: Washington, D.C., Denver, Dayton, Providence-Pawtucket, Philadelphia, and Seattle. This confirms the expected relationship between these two variables.

In the labor market areas of Washington, D.C., Atlanta, Pittsburgh, Miami, Detroit, Philadelphia, Newark, Birmingham, and New Orleans, the partial regression coefficients of the unemployment rate regressed upon the area size of the labor force were significantly different from zero. In two labor markets the signs of the partial regression coefficients were negative as expected, but in seven labor markets the signs of the

coefficients were positive. The apparent conclusion is the unemployment rate variable does not appear to be a measure of change in area job opportunities as originally hypothesized. The fact the two variables tend to vary in the same direction may be due to the effect of other variables highly correlated with the unemployment rate and not explicitly accounted for in this regression or may be due to a series of shifts of individuals from the unemployed category to a non-labor force category (or vice versa) [15].

The lag parameter λ was associated with the variable of the area mean wage and the lag parameter μ was associated with the two independent variables of the area help-wanted advertising index and the area seasonally adjusted unemployment rate which were to denote area job opportunities. The results, the lag coefficients (13 of λ and 7 of μ) being positive and significantly different from zero, indicate a lagged type of adjustment of the size of an area labor force towards its equilibrium with respect to changes in both the area wage rate and area job opportunities.

Another set of regressions was calculated under the assumption that the area mean wage had very little effect on area labor force size or possibly that average hourly earnings of production workers in manufacturing may not reasonably represent a measure of movements in the area mean wage. These regressions contained two independent variables; the area help-wanted advertising index (X_{i1}) and the area seasonally adjusted unemployment rate (X_{j1}). The lag parameter λ was associated with the former while the lag parameter μ was associated with the latter. The dependent variable again was the seasonally adjusted size of the area labor force (Y_i).

It was hypothesized that there would exist a positive relationship for the help-wanted index variable and a negative relationship for the unemployment rate variable, each with respect to the dependent variable, and that significant lags of adjustment would be estimated.

The results of the second set of regressions were similar to those of the first as depicted in Table 2. The estimated coefficients associated with the seasonally adjusted help-wanted index variable were positive and significantly different from zero in the labor market areas of Denver, Atlanta, Salt Lake City, Miami, Detroit, Providence-Pawtucket, Philadelphia, Seattle, and New Orleans. In general, the corresponding estimated lag coefficients for the above areas indicated either concurrent or lagged adjustment patterns.

The lag coefficient of -0.421 indicating the pattern of adjustment for the Atlanta labor market tended to indicate an overadjustment of labor force changes with respect to changes in area job vacancies. Such an adjustment path is depicted as the number one dotted line in Figure 1. The number two dotted line depicts a concurrent adjustment path,

TABLE 1

SELECTED STATISTICS FROM AN AUTOREGRESSIVE LEAST SQUARES DISTRIBUTED LAG MODEL CONTAINING TWO LAG PARAMETERS IN THE ESTIMATION OF LABOR SUPPLY FUNCTIONS FOR TWENTY-TWO LABOR MARKET AREAS, 1960–64

Labor Market Area	Regression Coefficients and Calculated Student t Statistics							
	a_0	a_1	b_1	b_1	λ	μ	β	R^2
Washington, District of Columbia	22.741	117.315 (3.07)‡	0.148 (1.88)*	11.091 (1.76)*	0.510 (2.29)†	0.678 (2.32)†	−0.070 (0.23)	0.9936
Richmond, Virginia	1.045	7.620 (1.11)	0.004 (0.20)	0.399 (0.49)	0.922 (9.73)‡	−0.205 (0.11)	−0.130 (0.07)	0.9863
Rochester, New York	−4.533	27.870 (1.62)	−0.080 (0.59)	−2.662 (0.71)	0.755 (4.73)‡	−0.077 (0.07)	−0.070 (0.06)	0.9714
Denver, Colorado	41.292	27.079 (1.37)	0.124 (3.22)‡	1.060 (0.56)	0.155 (0.36)	0.838 (12.09)‡	−0.224 (0.50)	0.9748
Omaha, Nebraska	66.701	2.917 (0.54)	0.016 (0.49)	−0.815 (0.46)	0.664 (2.45)†	−0.289 (0.51)	0.147 (0.20)	0.7498
Jacksonville, Florida	47.757	7.765 (0.71)	−0.036 (0.65)	0.615 (0.47)	0.191 (0.15)	0.491 (0.96)	0.307 (0.19)	0.6959
Atlanta, Georgia	52.651	17.389 (0.95)	−0.023 (0.33)	−3.790 (2.48)†	−0.298 (0.33)	0.960 (16.40)‡	−0.095 (0.10)	0.9798
Columbus, Ohio	77.268	16.102 (1.32)	0.037 (1.13)	−0.689 (0.36)	0.684 (3.77)‡	−0.231 (0.32)	−0.100 (0.11)	0.9585
Oklahoma City, Oklahoma	4.694	−4.220 (0.36)	−0.010 (0.80)	−0.477 (0.58)	1.018 (10.34)‡	−0.258 (0.80)	0.380 (1.17)	0.9955

TABLE 1 (*Continued*)

Labor Market Area	Regression Coefficients and Calculated Student t Statistics							
	a_0	a_1	b_1	b_3	λ	μ	β	R^2
Dayton, Ohio..........	80.524	20.048 (1.33)	0.064 (1.73)*	0.965 (1.02)	0.455 (1.24)	0.213 (0.49)	−0.069 (0.20)	0.9631
Salt Lake City, Utah	−13.954	19.124 (1.96)*	−0.046 (1.18)	1.135 (1.71)	0.827 (10.92)‡	−0.649 (3.99)‡	0.474 (2.04)*	0.9890
Pittsburgh, Pennsylvania..........	712.755	−52.129 (1.45)	0.245 (1.00)	4.347 (2.19)†	0.398 (1.25)	0.128 (0.34)	−0.220 (0.59)	0.9567
San Diego, California.......	71.136	−2.698 (0.24)	0.028 (0.54)	1.036 (0.80)	0.286 (0.42)	0.745 (3.71)‡	−0.264 (0.56)	0.7291
Miami, Florida..........	144.959	10.165 (0.56)	0.161 (1.64)	4.688 (6.35)‡	0.577 (1.88)*	−0.032 (0.22)	0.030 (0.09)	0.8695
Providence— Pawtucket, Rhode Island.......	80.818	15.994 (0.70)	0.087 (2.05)*	1.431 (0.90)	0.571 (1.42)	0.490 (1.45)	−0.530 (1.90)*	0.8446
Detroit, Michigan..........	119.049	−89.724 (1.34)	0.338 (1.58)	3.017 (1.73)*	0.463 (0.94)	0.870 (5.36)‡	−0.128 (0.27)	0.9315
Philadelphia, Pennsylvania..........	347.610	8.021 (0.33)	0.355 (2.37)†	10.098 (2.31)†	0.812 (5.19)‡	0.126 (0.45)	−0.282 (0.85)	0.8695
San Bernardino, California..........	28.122	4.202 (0.31)	−0.051 (0.61)	−0.270 (0.15)	1.038 (10.85)‡	−0.133 (0.09)	−0.171 (0.12)	0.9733
Newark, New Jersey..........	226.546	−5.901 (0.58)	0.103 (1.40)	10.041 (2.36)†	0.770 (4.53)‡	−0.425 (1.72)	0.177 (0.44)	0.6017

TABLE 1 (*Continued*)

Labor Market Area	a_0	a_1	b_1	b_2	λ	μ	β	R^2
				Regression Coefficients and Calculated Student t Statistics				
Birmingham, Alabama.........	17.221	3.929 (0.88)	0.007 (0.13)	1.289 (1.79)*	0.895 (5.65)‡	0.153 (0.35)	−0.416 (1.06)	0.7781
Seattle, Washington.........	28.499	−2.530 (0.12)	0.343 (3.06)‡	0.533 (0.43)	0.017 (0.00)	0.865 (15.82)‡	0.038 (0.00)	0.9577
New Orleans, Louisiana.........	76.029	13.339 (1.31)	0.051 (1.01)	−2.039 (1.97)*	0.437 (1.94)*	0.673 (4.37)‡	−0.311 (1.16)	0.9860

The calculated student t statistic is in parenthesis.
* Significantly different from zero at the .10 level.
† Significantly different from zero at the .05 level.
‡ Significantly different from zero at the .01 level.

Labor Supply Function Estimated:
$$Y_t = a_0(1-\mu)(1-\beta) + a_1 X_{i1t} - (\mu+\beta)a_1 X_{i1t} - (\mu+\beta)a_1 X_{i1t-1} + \mu\beta a_1 X_{i1t-2} + b_1 X_{f1t} - (\lambda+\beta)b_1 X_{f1t-1} + \lambda\beta b_1 X_{f1t-1} + \lambda\beta b_1 X_{f1t-2} + b_2 X_{f2t} - (\lambda+\beta)b_2 X_{f2t-1} + \lambda\beta b_2 X_{f2t-2}$$
$$+ (\lambda+\mu+\beta)Y_{t-1} - [(\lambda+\mu)\beta + \lambda\mu]Y_{t-2} + \lambda\mu\beta Y_{t-3} + e_t$$

Y_t = Seasonally Adjusted Size of Area Labor Force (in thousands)
X_{i1} = Average Hourly Earnings of Production Workers in Manufacturing (dollars per hour)
X_{f1} = Seasonally Adjusted Help-wanted Index (1957–59=100)
X_{f2} = Seasonally Adjusted Unemployment Rate (percent)
λ = Lag Coefficient Associated with Independent Variable(s) X_{it}
μ = Lag Coefficient Associated with Independent Variable(s) X_{ft}
β = First Order Autocorrelation Coefficient
R^2 = Coefficient of Determination

TABLE 2

SELECTED STATISTICS FROM AN AUTOREGRESSIVE LEAST SQUARES DISTRIBUTED LAG MODEL CONTAINING TWO LAG PARAMETERS IN THE ESTIMATION OF LABOR SUPPLY FUNCTIONS FOR TWENTY-TWO LABOR MARKET AREAS, 1960–64

Labor Market Area	Regression Coefficients and Calculated Student t Statistics						
	a_0	a_1	b_1	λ	μ	β	R^2
Washington, District of Columbia....	34.582	0.054 (0.59)	15.970 (2.74)†	0.950 (13.00)‡	-0.081 (0.25)	0.208 (0.54)	0.9924
Richmond, Virginia...........	5.943	0.015 (1.38)	0.499 (0.70)	0.976 (25.24)‡	-0.234 (0.24)	-0.149 (0.15)	0.9866
Rochester, New York........	46.155	-0.053 (0.54)	-2.809 (1.88)*	-0.145 (0.09)	0.911 (13.14)‡	-0.158 (0.10)	0.9721
Denver, Colorado......	48.871	0.108 (2.84)‡	0.286 (0.13)	0.864 (20.07)‡	0.191 (0.47)	-0.256 (0.60)	0.9722
Omaha, Nebraska........	76.867	-0.028 (0.79)	-1.380 (0.89)	0.715 (6.07)‡	-0.187 (0.20)	-0.055 (0.06)	0.7482
Jacksonville, Florida.......	57.815	-0.033 (0.66)	0.338 (0.27)	0.492 (1.41)	0.137 (0.03)	0.306 (0.07)	0.6884
Atlanta, Georgia.........	58.591	0.165 (2.12)†	-3.700 (3.34)‡	-0.421 (1.85)*	0.927 (18.41)‡	0.165 (0.51)	0.9827
Columbus, Ohio.......	72.160	0.034 (1.41)	-1.041 (0.55)	0.827 (8.73)‡	-0.168 (0.09)	-0.208 (0.11)	0.9482
Oklahoma City, Oklahoma.........	3.507	-0.011 (0.97)	-0.101 (0.13)	-0.234 (0.72)	0.368 (1.12)	0.986 (48.33)‡	0.9954

TABLE 2 (*Continued*)

Labor Market Area	Regression Coefficients and Calculated Student t Statistics						
	a_0	a_1	b_1	λ	μ	β	R^2
Dayton, Ohio................	27.713	0.028 (1.27)	0.232 (0.26)	0.922 (8.95)‡	-0.177 (0.05)	-0.139 (0.04)	0.9558
Salt Lake City, Utah........	8.673	0.073 (2.64)†	1.345 (1.87)*	0.915 (32.53)‡	-0.611 (3.31)‡	0.220 (0.96)	0.9889
Pittsburgh, Pennsylvania....	317.974	0.147 (0.60)	4.205 (1.98)*	0.459 (3.44)‡	0.500 (3.01)‡	-0.424 (1.84)*	0.9494
San Diego, California........	74.867	-0.0004 (0.007)	0.830 (0.67)	-0.187 (0.31)	0.736 (4.15)‡	0.243 (0.32)	0.7252
Miami, Florida..............	150.723	0.196 (2.68)†	4.781 (6.59)‡	0.098 (0.35)	-0.037 (0.27)	0.580 (2.09)†	0.8686
Providence—Pawtucket, Rhode Island...........	68.191	0.073 (1.84)*	1.010 (0.65)	0.769 (6.42)‡	0.378 (0.99)	-0.549 (2.00)*	0.8382
Detroit, Michigan...........	-1.418	0.132 (3.11)‡	5.565 (4.94)‡	0.992 (13.85)‡	-0.218 (1.13)	0.349 (1.53)	0.9621
Philadelphia, Pennsylvania...	368.831	0.333 (2.49)†	2.712 (1.37)	-0.157 (0.41)	0.788 (8.67)‡	0.148 (0.33)	0.8584
San Bernardino, California...	-22.336	-0.058 (0.74)	-0.668 (0.41)	-0.083 (0.09)	-0.180 (0.22)	0.107 (0.36)	0.9732
Newark, New Jersey........	122.286	-0.069 (0.87)	8.975 (2.12)†	0.899 (5.87)‡	-0.317 (0.84)	-0.059 (0.12)	0.5654

TABLE 2 (*Continued*)

Labor Market Area	Regression Coefficients and Calculated Student t Statistics						
	a_0	a_1	b_1	λ	μ	β	R^2
Birmingham, Alabama..........	32.804	0.032 (1.41)	1.441 (2.20)†	0.873 (6.20)‡	0.134 (0.38)	−0.431 (1.40)	0.7939
Seattle, Washington..........	37.937	0.380 (3.68)‡	2.115 (1.51)	0.838 (18.41)‡	0.042 (0.06)	−0.008 (0.01)	0.9624
New Orleans, Louisiana..........	70.603	0.092 (1.73)*	−2.033 (2.32)†	0.372 (1.31)	0.770 (5.01)‡	−0.252 (0.88)	0.9852

NOTES:

The calculated student t statistic is in parentheses.
* Significantly different from zero at the .10 level.
† Significantly different from zero at the .05 level.
‡ Significantly different from zero at the .01 level.

Labor Supply Function Estimated:

$$Y_t = a_0(1-\lambda)(1-\mu)(1-\beta) + a_1 X_{it} - (\mu+\beta)a_1 X_{it-1} + \mu\beta a_1 X_{it-2} + b_1 X_{jt} - (\lambda+\beta)b_1 X_{jt-1} + \lambda\beta b_1 X_{jt-2} + (\lambda+\mu+\beta)Y_{t-1} - [(\lambda+\mu)\beta+\lambda\mu]Y_{t-2}$$
$$+\lambda\mu\beta Y_{t-3} + e_t$$

Y_t = Seasonally Adjusted Size of Area Labor Force (in thousands)
X_{it} = Seasonally Adjusted Help-wanted Index (1957–59 = 100)
X_{jt} = Seasonally Adjusted Unemployment Rate (per cent)
λ = Lag Coefficient Associated with Independent Variable(s) X_{it}
μ = Lag Coefficient Associated with Independent Variable(s) X_{jt}
β = First Order Autocorrelation Coefficient
R^2 = Coefficient of Determination

adjustment occurring within the two-month measured time period utilized in the investigation. This type of adjustment seems to have typified the situation in Miami, Philadelphia, and New Orleans whose mean seasonally adjusted unemployment rates over the five-year period were 7.17 percent, 6.50 percent, and 5.91 percent, respectively. The pressure of relatively substantial unemployment during this period may have aided the adjustment process in that there was an active group of job seekers responding to area job vacancies.

On the other hand a lagged adjustment path seemed to characterize the other substantial unemployment areas of Seattle, Detroit, and Providence-Pawtucket together with the two areas of Denver and Salt Lake City. The following industries are characteristic of the former labor surplus areas: Seattle: aircraft, shipbuilding, and lumber; Detroit: automobiles, household appliances, and tools and dies; Providence-Pawtucket: industrial machinery, jewelry, and a declining textile industry. The latter expanding areas of Denver and Salt Lake City are primarily trade centers for extensive surrounding areas. A lagged adjustment path of the local labor force in response to changes in local job vacancies for these particular areas may be due to time required for in-migration and/or local lack of individuals with needed skills.

' Ten of the twenty-two labor markets had a statistically significant relationship between the area unemployment rate independent variable and the area labor force size dependent variable. The estimated coefficients were negative for three areas as hypothesized but positive for seven areas. The positive relationship could be due to a series of shifts of individuals from non-labor force status into the unemployment group or vice versa. Migration, of course, may be the underlying factor of the resultant positive relationship. The estimated lag coefficients associated with the unemployment rate variable, in all instances but one, indicated either a concurrent or lagged adjustment path.

Further support for the regression and lag coefficient estimates is provided by recently published figures of the number and duration of unfilled job openings in local public employment offices although there is a slight difference in time periods [22]. The areas of Atlanta and Miami were reportedly experiencing a relatively small proportion of jobs remaining unfilled longer than thirty days, 22.6 and 10.7 percent, respectively, substantiating the estimated patterns of labor force adjustment characterized as overadjustment or concurrent adjustment. The Miami regressions and the reported figure of 10.7 percent of total unfilled jobs remaining unfilled in excess of thirty days were undoubtedly influenced by the influx of Cuban refugees during the last five years. On the other hand, the industrialized areas of Seattle, Detroit, and Providence, which experienced a significant lagged labor force adjustment, had proportions

Units
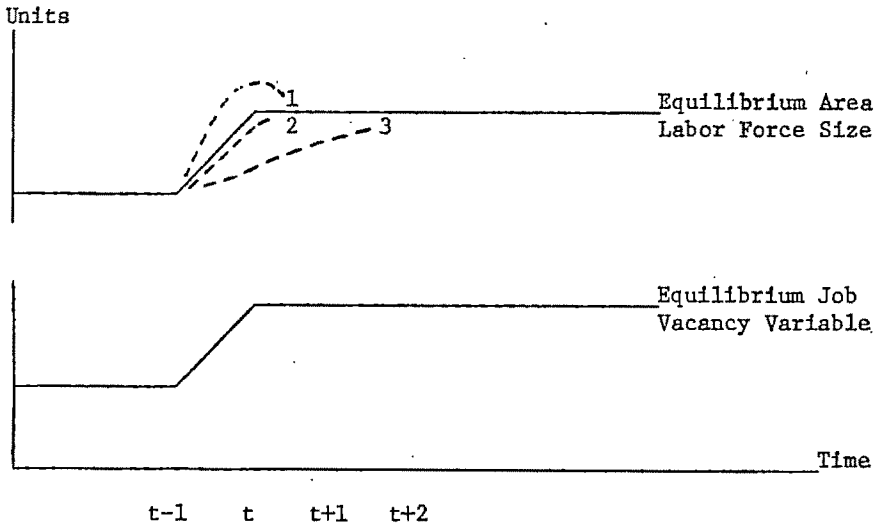
FIGURE 1

ESTIMATED ADJUSTMENT PATHS OF ACTUAL AREA
LABOR FORCE SIZE TOWARDS EQUILIBRIUM

of 87.0 percent, 44.5 percent, and 55.8 percent, respectively, of unfilled
job openings which remained unfilled thirty days or longer. The addi-
tional variables of area industry and occupational mixes undoubtedly
influence the above proportions and area labor force adjustment; how-
ever, it is beyond the scope of the present study to attempt to account
for these additional factors.

Conclusions

It is evident from the autoregressive least squares regression analysis
of the twenty-two labor market areas that the job vacancy variable of
the area help-wanted advertising index is a relatively more important
variable than the area mean wage in the explanation of the adjustment
process of an area labor force to its equilibrium level. The area unem-
ployment rate does not appear to be a proxy variable measuring changes in
area job opportunities. However, the positive relationships estimated
in most labor market areas between variation in area labor force size
and variation in both independent variables of the area mean wage and
the area help-wanted advertising index do confirm a priori expectations.
The estimates of the two lag parameters were, in general, between
zero and plus one and significantly different from zero as confirmed by
the large calculated student t statistics associated with the estimates.
This information confirms the expectation of significant lags existing in
the adjustment of the area labor force towards its equilibrium level. It

indicates that this adjustment can be described as a distributed lag adjustment as it is spread over several time periods. It also signifies that long-run labor force elasticities with respect to each of the independent variables are greater than the corresponding short-run elasticities [15]. In conclusion, the autoregressive least squares distributed lag model containing two lag parameters is not only applicable to this type of investigation but it also provides information concerning the dynamic adjustment process of the area labor force which is not available from an ordinary least squares regression model.

REFERENCES

1. Cicely Blanco, "The Determinants of Interstate Population Movements," *J. of Reg. Sci.*, Summer, 1963, pp. 77–84.
2. William G. Bowen and T. A. Finegan, "Labor Force Participation and Unemployment," in Arthur M. Ross (ed.), *Employment Policy and the Labor Market* (Univ. of California Press, 1965), pp. 115–61.
3. ———, "Discussion," in Robert A. Gordon and Margaret S. Gordon (ed.), *Prosperity and Unemployment* (John Wiley & Sons, 1966), pp. 113–21.
4. Robert L. Bunting, "A Test of the Theory of Geographic Mobility," *Ind. and Labor Rela. Rev.*, Oct., 1961, pp. 75–82.
5. Thomas Dernburg and Kenneth Strand, "Hidden Unemployment 1953–1962: A Quantitative Analysis by Age and Sex," *A.E.R.*, Mar., 1966, pp. 71–95.
6. Wayne A. Fuller and James E. Martin, "The Effects of Autocorrelated Errors on the Statistical Estimation of Distributed Lag Models," *J. of Farm Econ.*, Feb., 1961, pp. 71–82.
7. ———, "A Note on the Effects of Autocorrelated Errors on the Statistical Estimation of Distributed Lag Models," *J. of Farm Econ.*, May, 1962, pp. 407–10.
8. Abraham L. Gitlow, *Labor and Industrial Society*, rev. ed. (Richard D. Irwin, Inc., 1963).
9. H. O. Hartley, "The Modified Gauss-Newton Method for the Fitting of Non-Linear Regression Functions by Least Squares," *Technometrics*, May, 1961, pp. 269–80.
10. L. M. Koyck, *Distributed Lags and Investment Analysis* (Amsterdam: North-Holland Pub. Co., 1954).
11. James E. Martin, "An Application of Distributed Lags in Short-run Consumer Demand Analysis." (Unpublished Ph.D. dissertation, Iowa State Univ., 1962).
12. ———, "Computer Programs For Estimating Certain Classes of Non-linear Distributed Lag Models." Misc. Publication No. 546, Department of Agricultural Economics, Univ. of Maryland, May, 1965, pp. 1–28.
13. ———, "The Use of Distributed Lag Models Containing Two Lag Parameters in the Estimation of Elasticities of Demand," *J. of Farm Econ.*, Dec., 1963, pp. 1474–1481.
14. Jacob Mincer, "Labor-Force Participation and Unemployment: A Review of Recent Evidence," in Robert A. Gordon and Margaret S. Gordon (ed.), *Prosperity and Unemployment* (John Wiley & Sons, 1966), pp. 73–112.
15. Maurice Pfannestiel, "A Distributed Lag Analysis of Adjustment of Size of Labor Force in Selected Major Labor Market Areas in the United States." (Unpublished Ph.D. dissertation, Oklahoma State Univ., 1967.)
16. National Industrial Conference Board, Inc., *New Index of Help-wanted Advertising*. Technical Paper Number Sixteen (Nat. Ind. Conf. Bd., 1964).
17. Robert L. Raimon, "Interstate Migration and Wage Theory," *Rev. of Econ. and Statis.*, Nov., 1962, pp. 428–38.
18. Kenneth Strand and Thomas Dernburg, "Cyclical Variation in Civilian Labor Force Participation," *Rev. of Econ. and Statis.*, Nov., 1964, pp. 378–91.
19. Alfred Tella, "The Relation of Labor Force to Employment," *Ind. and Labor Rela. Rev.*, Apr., 1964, pp. 454–69.
20. ———, "Labor Force Sensitivity to Employment by Age, Sex," *Ind. Rela.*, Feb., 1965, pp. 69–83.
21. U.S. Congress, Subcommittee on Economic Statistics of the Joint Economic Committee. *Hearings on Job Vacancy Statistics*, 89th Congress, 2nd Session, May 17–18, 1966.
22. U.S. Department of Labor, Bureau of Employment Security, *Area Trends in Employment and Unemployment*, 1962–66.
23. ———, *The Labor Market and Employment Security*, 1960–63.
24. ———, *Employment and Earnings*, 1960–66.

RESOURCE ALLOCATION IN UNSELFISH ENVIRONMENTS*

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I. *Introduction*

In this paper, the static and dynamic properties of a single resource
allocation mechanism are analyzed. Interest in such a mechanism stems
from two trains of economic thought. The first, typified by the work of
Lange [6], Lerner [7], and Hayek [4], is concerned with comparing differ-
ent economic systems. In particular, the debate deals with the relative
efficiency, with respect to optimality and informational requirements,
of a centrally planned economy compared with a decentralized economy.

The second line of thought stems from modern welfare economics.
It is known (e.g., Debreu [2]) that, under suitable environmental con-
ditions, the competitive price system is a desirable allocative mecha-
nism. Specifically, competitive equilibria are Pareto-optimal and any
Pareto-optimum is a competitive equilibrium following, if necessary, a
redistribution of initial resources. Furthermore, under slightly stronger
conditions, the competitive process is dynamically stable. (See Negishi
[11].)

An obvious question is whether there exist allocation mechanisms,
other than the price system, which have the same desirable properties as
the competitive process but in a wider class of environments (i.e., for
a wider range of preferences and technologies). Evaluation of the mecha-
nism also involves its informational properties, since one possible system
is a beneficent, omniscient central planner.

The seminal paper by Hurwicz [5], in which a framework for the
comparison of different allocation mechanisms is proposed, represents a
joining of the two streams of thought. In this context the mechanism
becomes the variable of the problem rather than a given invariant.
Different mechanisms are compared with respect to such concepts as
decentralization and informational efficiency.

In this approach to comparative systems analysis,[1] each economic
agent (e.g., households, firms, etc.) is viewed as possessing knowledge
of the economic environment specific to them (e.g., their preferences)
which they somehow transmit to the other agents. In the competitive
Walrasian system, for example, economic agents transmit their excess

[1] The work of J. Marschak [9], T. Marschak [10], and R. Radner [13], in the theory of teams,
deals with similar problems.

demands to an "auctioneer" who responds with price messages. Complete description of such a process involves stating: (1) the form messages are to take, (2) who the senders and recipients of messages are, and (3) how each agent utilizes the information in the messages. In the competitive process, the latter involves maximizing profits or utility, given the prices.

Hurwicz proposes and examines [5] two alternative processes, different from the Walrasian mechanism. One of these is Pareto-satisfactory in environments with indivisible commodities (a property the competitive system does not have), though only in the absence of externalities. The messages in both processes consist of sets of many points (specifically, upper contour sets) as opposed to the single points used by the competitive process.

The process posited in this paper, on the other hand, uses single point messages[2] and is Pareto-satisfactory in economic environments in which externalities in the preference orderings exist. Divisibility of commodities is, however, required.

As a final point it should be recognized that questions concerning the existence and performance of allocation mechanisms are not altogether academic. Economists are being asked by developing economies, administrative bureaus, firms, etc., to recommend institutional structures and information processing and planning methods which are better, by some criterion, than the existing systems.

In Section II a formal description is presented. This includes preferences, production possibility sets, etc. In Section III the P-process is described as a mechanism which allocates resources in this environment. In Section IV, the static and dynamic properties of the P-process are discussed.

II. *The Economic Environment*

This section contains a description of the economic environment and provides a basis for the rest of the paper.

We describe the economic environment with the aid of the following notation and terminology:

$I \equiv \{1, \cdots, N\}$: the set of economic agents (firms, consumers, etc.);

$J \equiv \{1, \cdots, M\}$: the set of economic commodities;

$\mathfrak{X}$: the commodity (resource) space (assumed in this paper to be the NM-dimensional Euclidean space);

$X \subseteq \mathfrak{X}$: the set of admissible consumptions:

$x(t) = [x_1^1(t), x_2^1(t), \cdots, x_M^N(t)] \in X$: an allocation of resources where

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[2] The informational properties of the process are not discussed in this paper; however, it is shown in [8] that, using Hurwicz's definition, it is informationally incomparable with Hurwicz's quasi-competitive process.

$x_j{}^i$ respresents agent i's consumption (holdings) of commodity j at time t;

$\succeq i$: the preference relation of agent i which is a complete, transitive, and reflexive relation on X;

$x(0) \in X$: the initial allocation of resources in the economy;

Definition 1: $\mathcal{E}$ is a set of economic environments, where $e_t \in \mathcal{E}$, the state of the economy at time t; i.e.,

$$e_t \equiv \{I, J, X, \succeq_1, \cdots, \succeq_N, x(0), x(t)\}.$$

This paper deals only with economic environments in which there is no production.[3] Such environments are called "exchange environments." It should also be noticed that preference relations are defined over all commodity holdings, not just the individual agent's holdings. The nonexternality case occurs when the agents' preferences are independent, or selfish.

Definition 2: (Hurwicz [5, definition 5].) An economic agent, $i \in I$, is said to be selfish, given the four allocations w, x, y, z all belonging to X, if

$$w \succeq_i x, \quad w^i = y^i, \quad \text{and} \quad x^i = z^i$$

implies

$$y \succeq_i z,$$

where $w^i = [w_1{}^i, \cdots, w_M{}^i]$.

III. *The P-process*

The P-process is an orderly sequence of messages and calculations. Time is divided into intervals of equal length $(t, t+1)$, $(t+1, t+2)$, and so on. Each of these intervals is in turn subdivided into three equal parts, $(t, t+1/3)$, $(t+1/3, t+2/3)$, and $(t+2/3, t+1)$. At each time t, each $i \in I$ computes a direction of change, to which he would agree, and notifies the others. At $t+1/3$, each agent picks a "best" (in a sense to be defined below) reallocation from the set of all permissible reallocations as determined by the messages received. The "best" reallocation is his new message. At $t+2/3$, the actual direction of reallocation is determined. At $t+1$, reallocation takes place in the determined direction to the extent that no agent's utility is decreased, and then a new set of preferred directions is computed.

For a rigorous description of the P-process, the following definitions are required.

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[3] The analysis can be extended to cover environments in which production is possible through the use of "trade indifference" surfaces—a concept familiar to international economists.

Definition 3: For each $i \in I$, and each $\bar{x} \in X$, let

$$^iG(\bar{x}) \equiv \{x \in X \mid x \succeq_i \bar{x}\}.$$

$^iG(x)$ is called the upper contour set of x.

Definition 4: For each $i \in I$, and each $x \in X$, the vector $^i\delta(x) = [^i\delta_1^1(x), \cdots, ^i\delta_M^N(x)]$ is defined as follows:

(a) if there exists a hyperplane through x bounding for $^iG(x)$, then $^i\delta(x)$ is the normal to one such hyperplane so that $^i\delta(x)$ lies in the same half-space as $^iG(x)$,

(b) if no such hyperplane exists, then $^i\delta(x) = 0$.

Definition 5: For each $i \in I$, and $x \in X$, let

$$^iP(x) = [^iP_1^1(x), \cdots, ^iP_M^N(x)]$$

be a vector where for each $k \in I$ and $j \in J$,

$$^iP_j^k(x) = \sum_{r=1}^{N} (^{i}\delta_j^k(x) - ^{i}\delta_j^r(x)).$$

The interpretation of $^i\delta(x)$ and $^iP(x)$ becomes clear if we assume preferences can be represented by a continuously differentiable utility function. In that case, $^i\delta(x)$ is the direction of the gradient, or vector of first partial derivatives, of agent i's utility function at x and is an indication of i's preferred direction of change. The quantity $^iP_j^k(x)$ shows the effect on i's utility of a transfer of N units of commodity j to agent k accomplished by decreasing x_j^r by one unit for all $r \in I$. More technically, $^iP(x)$ is the projection of $^i\delta(x)$ onto the set

$$\left\{ Z \in X \,\middle|\, \sum_{r=1}^{N} Z_j^r = \sum_{r=1}^{N} x_j^r \text{ for all } j \in J \right\}.$$

It can be shown[4] that if $i \in I$ is selfish, then

$$^i\delta(x) = (0, \cdots, 0, ^i\delta^i(x), 0, \cdots, 0)$$

and

$$^iP(x) = [-^i\delta^i(x), \cdots, -^i\delta^i(x), (N-1)^i\delta^i(x), -^i\delta^i(x), \cdots, -^i\delta^i(x)].$$

The form of these vectors indicates why selfishness allows the use of decentralized messages as defined by Hurwicz [5, definition 10].

Symbolically, the P-process can now be formulated as follows:[5]

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[4] The proof of this statement, as well as those of any other theorem in this paper, is contained in [8].

[5] Statements beginning with M describe the form messages are to take and who the senders and recipients are. Statements beginning with C describe what each agent is to do with the messages received. Statements beginning with R describe how each agent is to revise his knowledge of the economic environment.

for any t and $i \in I$, let

$$\overset{i}{\epsilon_t} = \{I, J; X, \succeq_i, x(0), x(t)\},$$

be i's knowledge of e_t. Notice that i need not know anything about the others' preferences.

(C.1) During the interval $(t, t+1/3)$ each $i \in I$ calculates ${}^i P[x(t)]$.

(M.1) The message of agent i to all other agents is ${}^i P[x(t)]$.

(R.1)
$$\overset{i}{\epsilon_{t+1/3}} = \overset{i}{\epsilon_t}.$$

(C.2) During the interval $(t+1/3, t+2/3)$ each $i \in I$ calculates[6] as follows:

If ${}^i P[x(t)] = 0$, do nothing.
If ${}^i P[x(t)] \neq 0$, solve the following linear program:
maximize
${}^i P[x(t)] \cdot y$, over all $y \in X$,
subject to[7]

$$^k P[x(t)] \cdot y \geq 0 \qquad \text{for all } k \in I,$$

and

$$-1 \leq \overset{k}{y_j} \leq 1 \qquad \text{for all } k \in I, j \in J.$$

Definition 6: Given $x \in X$, and ${}^k P(x)$ for $k = 1, \cdots, N$, if ${}^i P(x) \neq 0$, let $Y^i[x; {}^1 P(x), \cdots, {}^N P(x)] = \{y \in X \mid {}^i P[x] \cdot y$ is a maximum subject to ${}^k P(x) \cdot y \geq 0$ and $-1 \leq y_j{}^k \leq 1$ for $k \in I, j \in J\}$.

---

[6] Plott [12], in the context of determining potential politically "acceptable proposals," outlines an algorithm which generates $2N$ (NM-dimensional) vectors, ${}^1 y, \cdots, {}^{2N} y$, such that if ${}^k P(x) \cdot y > 0$ for all $k \in I$, then

$$y \in \left\{ x \mid x = \sum_{i=1}^{2N} \lambda_i \cdot {}^i y \text{ for } \lambda_i > 0 \right\}.$$

In our case we are only interested in one such y and can, therefore, dispense with the $2N$ maximizations he considers.

[7] We use the conventional vector notations: if $x = (x^1, \cdots, x^n)$ and $y = (y^1, \cdots, y^n)$,

$$x \geq y \quad \text{if } x^i \geq y^i, \quad i = 1, \cdots, n$$
$$x > y \quad \text{if } x^i > y^i, \quad i = 1, \cdots, n$$

and

$$x \cdot y = \sum_{k=1}^{n} x^i y^i.$$

Definition 7: For $y \in X$ and for all $k \in I$ and $j \in J$, let

$$\overset{k}{\eta_j}(y) = \overset{k}{y_j} - \frac{1}{N} \sum_{r=1}^{N} \overset{r}{y_j},$$

and let

$$\eta(y) = [\overset{1}{\eta_1}(y), \overset{1}{\eta_2}(y), \cdots, \overset{N}{\eta_M}(y)].$$

(M.2) The message of agent i to all other agents is $^i\eta(t)$, where

$$^i\eta(t) = 0, \quad \text{if } ^iP[x(t)] = 0,$$

and

$$^i\eta(t) = \eta(y)$$

for one $y \in Y^i\{x(t), {}^1P[x(t)], \cdots, {}^NP[x(t)]\}$, if $^iP[x(t)] \neq 0$.

(R.2) $$\overset{i}{\epsilon_{t+2/3}} = \overset{i}{\epsilon_{t+1/3}}.$$

(C.3) During the interval $(t+2/3, t+1)$, each $i \in I$ calculates

$$T(t) = \sum_{k=1}^{N} {}^k\eta(t).$$

(M.3) The message of agent i to all other $k \in I$ is β^i, where $\beta^i = 0$, if $T(t) = 0$, and

$$\beta^i = \max\{\lambda \geq 0 \mid x(t) + \lambda \cdot T(t) \succeq_i x(t) + \lambda^* T(t), \quad \text{for all } \lambda^*$$

such that $x(t) + \lambda^* \cdot T(t) \in X\}$, if $T(t) \neq 0$.

(R.3) $$\overset{i}{\epsilon_{t+1}} = \{I, J; X, \succeq_i, x(0), x(t) + \beta \cdot T(t)\},$$

where

$$\beta = \min\{\beta^1, \cdots, \beta^N\}$$

and return to (C.1).

A distinctive feature of the P-process is that reallocation of resources occurs even though there is no message equilibrium. (See R.3.) This is not a characteristic, for example, of the Walrasian competitive system, a tatonnement process. In that scheme, trading occurs only when message equilibrium (price equilibrium) is attained. Consequently, the P-process falls into the class of mechanisms generally referred to as non-tatonnement processes.[8]

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[8] See, for example, Uzawa [15] and Hahn and Negishi [13].

Definition 8: The state of the P-process at any time t is $x(t) \in X$; that is, the state at t is the consumption by all agents at t.

Definition 9: $x \in X$ is an equilibrium[9] (state) of the P-process if $x(T) = x$ implies $x(t) = x(T)$ for all $t \geq T$.

IV. *Static and Dynamic Properties of the P-process*

It is desirable that any adjustment process search for, find, and remain at Pareto-optimal allocations. The P-process does this in exchange environments when the commodity space is the non-negative orthant of Euclidean space, the upper contour sets are convex, closed, and have smooth boundaries, and some agent has non-thick indifference classes. Theorem 2 states that the P-process searches for Pareto-optimal allocations; that is, if the present allocation is non-optimal, a new allocation will be generated. Theorem 5 states that the P-process finds Pareto-optimal allocations; that is, for any initial allocation, the P-process converges to some Pareto-optimal allocation as time goes by. Theorem 1 states that the P-process stays at Pareto-optimal allocations; that is, if the present allocation is Pareto-optimal, reallocations will not be Pareto-inferior.

It is also possible to compare the more familiar competitive equilibria with P-process equilibria. Theorem 3 states, for the environments in the previous paragraph, that if no agent has thick indifference classes, the set of competitive equilibria is contained in the set of P-process equilibria. If preferences are also selfish and there exist no satiation consumptions, then according to Theorem 4, the set of P-process equilibria, such that each agent consumes positive amounts of each commodity, is contained in the set of competitive equilibria. Furthermore, Arrow's example of the failure of competitive equilibrium, where some agent does not consume some commodity, is a P-process equilibrium. In summary, the P-process possesses the same properties as the competitive process but in a larger class of economic environments.

A table, summarizing the results of this section, is provided at the end. To display these properties of the P-process, additional definitions must be introduced.

Definition 10: For any $x \in X$ and $Z \in X$, x is consistent with Z if

$$\sum_{k=1}^{N} x_j^k = \sum_{k=1}^{N} Z_j^k \quad \text{for all } j \in J.$$

We let

$$C(x) = \{Z \in X \mid Z \text{ is consistent with } x\}.$$

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[9] It is possible for the P-process to be in an equilibrium state without being in message equilibrium. For an appropriate comment on the desirability of this property, see Reiter [14].

It is possible to show that, for the P-process, $x(t)$ is consistent with $x(t-1)$ and, therefore, with $x(0)$.

Definition 11: An allocation $x \in X$ is Pareto-optimal with respect to $x(0)$ if for all $Z \in C[x(0)] = C(x)$,

$$Z \in \bigcap_{i \in I} {}^iG(x)$$

implies

$$Z \underset{i}{\sim} x \qquad \text{for all } i \in I,$$

where $Z \underset{i}{\sim} x$ if both $Z \underset{i}{\succeq} x$ and $Z \underset{i}{\preceq} x$ hold.

The next two definitions involve a concept of equilibrium different from that of Definition 9. Equilibrium here is in reference to the utility, or value, space. This allows us to consider sets of equilibrium outcomes which are essentially the same; a property Hurwicz calls essential single-valuedness [5, p. 31].

Definition 12: For each $x \in X$

$$V(x) = \left\{ Z \in X \mid Z \underset{i}{\sim} x \text{ for all } i \in I \right\}.$$

If $Z \in V(x)$, Z is said to be value-equivalent to x.

Definition 13: A state $x \in X$ of the P-process is a value-equilibrium if $x(T) = x$ implies

$$x(t) \in V(x) \qquad \text{for all } t \geq T.$$

Definition 14: A process is essentially Pareto-satisfactory with respect to $x(0)$ in an exchange environment if

(a) $x \in X$ is a value-equilibrium implies x is Pareto-optimal with respect to $x(0)$ (called "essential nonwastefulness") and

(b) $x \in X$ is Pareto-optimal with respect to $x(0)$ implies x is a value-equilibrium (called "essential unbiasedness").

We now present the underlying Assumptions and then state the Theorems.

Assumption 0: $X = E^+$, the non-negative orthant of NM-dimensional Euclidean space.[10]

Assumption 1: (convexity) For each $x \in X$ and each $i \in I$, ${}^iG(x)$ is convex [i.e., if $y \in {}^iG(x)$ then $x + \theta(y - x) \in {}^iG(x)$ for all θ, $0 \leq \theta \leq 1$].

Both of these assumptions are familiar and require no explanation. We therefore proceed to

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[10] It is possible to modify the P-process so that this environmental restriction is unnecessary. Let X be a vector space and $X = X^1x \cdots xX^N$ (i.e., X is the Cartesian product of its projections, X^i). Furthermore, let X^i be convex. We can then define a new NM-dimensional vector, $N+i\delta(x)$ where, instead of ${}^iG(x)$ in definition 4, we use X^i. $N+iP(x)$ is utilized in computation and message transmission in the same way that ${}^iP(x)$ is. Everything else remains unchanged.

Assumption 2: (upper semi-continuity) For each $x \in X$ and every $i \in I$, $^iG(x)$ is closed.

Assumption 3: (local non-thickness) For each $x \in X$, there is some $i \in I$ such that $x \in$ Boundary $^iG(x)$.

Assumption 3′: (non-thickness for some agent) There is some $i \in I$, such that for each $x \in X$, $x \in$ Boundary $^iG(x)$.

Assumption 3″: (non-thickness) For every $i \in I$ and every $x \in X$, $x \in$ Boundary $^iG(x)$.

Assumption 4: (smoothness) For each $x \in X$ and $y \in \mathfrak{X}$ let $Z(\theta) = x + \theta(y-x)$, where θ is a scalar. If, for some $i \in I$, $^i\delta(x) \cdot (y-x) > 0$, then there exists a $\theta' > 0$ such that $Z(\theta') \in {}^iG(x)$.

Assumption 5: (possibility of joint action) For each $x \in X$, if x is not Pareto-optimal, then there exists $y \in C(x)$ such that

$$y \in \text{Interior} \left[\bigcap_{i \in I} {}^iG(x) \right].$$

Assumption 2 is half of what has been called continuity (Debreu [2, p. 56]) since it is a necessary condition for the existence of a continuous utility function. Assumption 3 allows thick indifference classes. Assumption 3′ requires non-thick indifference classes for at least one agent, while Assumption 3″ requires this for all agents.

Assumption 4 is less straightforward than the rest. In effect it is a requirement that the boundary of $^iG(x)$ be smooth (i.e., have no cusps or sharp corners). Its relationship to the more conventional assumptions found in the literature is somewhat in doubt. For example, it neither implies nor is implied by the assumption of strong-convexity of preferences. Possibly the easiest interpretation to understand is that if there is a utility function for $i \in I$, say $U(x)$, such that $^i\delta(x)$ is continuous over the set $\{x \in E^+ | U(x) = \text{constant}\}$, then the Assumption 4 holds. The converse is true only if indifference classes are non-thick (i.e., have no interiors).

Assumption 5 is a non-degeneracy assumption of the type that is called a "constraint-qualification" in the literature of mathematical programming. The relation between it and Corollary 3 to Theorem 3 in Arrow *et al.* [1] is obvious. In that Corollary it is shown that the Lagrangian method for nonlinear programming may be applied if there is a feasible vector which satisfies all nonlinear constraints with strict inequality.

From these assumptions the following theorems regarding the static properties of the P-process can be derived.

Theorem 1: (essential unbiasedness) In any exchange environment satisfying Assumptions 0 and 1, if $x \in X$ is Pareto-optimal with respect to $x(0)$ then x is a value equilibrium of the P-process.

TABLE 1

ASSUMPTIONS USED IN PROOFS OF THEOREMS

	T.1 Essential Unbiased-ness	T.2 Essential Non-waste-fulness	T.3 Price Equilibria Are P-process Equilibria	T.4 P-process Equilibria Are Price Equilibria	T.5 Value Stability
A.1 Convexity of upper contour sets	x	x	x	x	x
A.2 Closure of upper contour sets..		x		x	x
A.3 Local non-thickness		x			
A.3′ Non-thickness for some agent..		s			x
A.3″ Non-thickness for all agents ..		s	x	x	s
A.4 Smoothness		x		x	x
A.5 Joint action possible..........		x		s	x
A.6 Continuously differentiable utility functions..............		s	s	s	x
Selfish preferences	s	s	s	x	s

Theorem 2: (essential nonwastefulness) In any exchange environment satisfying Assumptions 0, 1, 2, 3′, 4, and 5, if $x \in X$ is a value-equilibrium of the P-process then x is Pareto-optimal with respect to $x(0)$.

Definition 15: An allocation $x \in X \subseteq E$ is a competitive exchange equilibrium if there exists a price vector, $\pi = (\pi_1, \cdots, \pi_M) \neq 0$ such that for each $i \in I$ and for any $y \in X$, $y \succ_i x$ implies $\pi \cdot (y^i - x^i) > 0$.

Theorem 3: For any exchange environment satisfying Assumptions 0, 1, and 3″, if $x \in X$ is a competitive exchange equilibrium, then x is a value-equilibrium of the P-process.

Theorem 4: In any exchange environment satisfying Assumptions 0, 1, 2, 3″ and 4, if

(a) every $i \in I$ is selfish,

(b) $x > 0$, and

(c) x is not a satiation consumption for any $i \in I$,

then x is a value-equilibrium of the P-process only if x is a competitive exchange equilibrium.

The next definition and assumption enable us to characterize the dynamic properties of the P-process.

Definition 16: The P-process is (globally) value-stable if, for any initial allocation $x(0) \in X$, $x(t) \to V(\bar{x})$ as $t \to \infty$, where $\bar{x} \in X$ is Pareto-optimal.[11]

Assumption 6: For each $i \in I$, there exists a real-valued utility func-

[11] $x(t) \to V \subseteq X$ as $t \to \infty$, if $d[x(t), V] = \inf_{y \in V} d[x(t), y] \to 0$ as $t \to \infty$.

tion, $U^i(x)$, representing $\succeq_i$, which is continuously differentiable at all $x \in X$.

We can now assert

Theorem 5: For any exchange environment satisfying Assumptions 0, 1, 2, 3', 4, 5 and 6, the P-process is value-stable.

The following table is provided as a summary of the theorems dealing with the static and dynamic properties of the P-process. The columns of Table 1 list the theorems and the rows list the assumptions. An x is placed in the box if that assumption is used in proving that theorem. An s is placed in the box if that assumption could be used in proving that theorem, although a weaker one was actually used.

REFERENCES

1. K. J. Arrow, L. Hurwicz, and H. Uzawa, "Constraint Qualifications in Maximization Problems," *Naval Research Logistics Quar.*, 1961, pp. 175–91.
2. G. Debreu, *Theory of Value* (John Wiley and Sons, 1959).
3. F. Hahn and T. Negishi, "A Theorem on Non-Tatonnement Stability," *Econometrica*, 1962, pp. 62–65.
4. F. A. Hayek, "The Use of Knowledge in Society," *A.E.R.*, 1945, pp. 519–30.
5. L. Hurwicz, "Optimality and Informational Efficiency in Resource Allocation Processes," *Proceedings of a Symposium on Mathematical Methods in the Social Sciences* (Stanford Univ. Press, 1960), pp. 27–46.
6. O. Lange, "On the Economic Theory of Socialism," *On the Economic Theory of Socialism*, B. Lippincott, ed. (Univ. of Minnesota Press, 1938) pp. 57–142.
7. A. P. Lerner, *The Economics of Control* (Macmillan Co., 1944).
8. J. Ledyard, "A Convergent Pareto-Satisfactory Non-Tatonnement Adjustment Process for a Class of Unselfish Exchange Environments." (Unpublished Ph.D. dissertation, Purdue Univ., 1968).
9. J. Marschak, "Elements for a Theory of Teams," *Management Science*, 1955, pp. 127–37.
10. T. Marschak, "Centralization and Decentralization in Economic Organizations," *Econometrica*, 1959, pp. 399–430.
11. T. Negishi, "The Stability of a Competitive Economy: A Survey Article," *Econometrica*, 1964, pp. 635–69.
12. C. Plott, "A Method for Finding 'Acceptable Proposals' in Group Decision Processes," *Papers on Non-Market Decision Making*, 1967, pp. 45–57.
13. R. Radner, "The Application of Linear Programming to Team Decision Problems," *Management Science*, 1959, pp. 143–50.
14. S. Reiter, "A Market Adjustment Mechanism," *Institute for Quantitative Research in Economics and Management* (Purdue Univ., 1960).
15. H. Uzawa, "On the Stability of Edgeworth's Barter Process," *Int. Econ. Rev.*, 1962, pp. 218–32.

PROBLEMS IN PRICING AND GROWTH

RELATIVE PRICES IN A MACROECONOMIC MODEL*

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While there has been much discussion of the relationship between the flexibility of the general price level and the level of activity, the relationship between variations in relative commodity prices and activity levels has received little attention in macroeconomic models, with the notable exception of two-sector growth models. There is no doubt that there are many propositions about employment theory and policy for which this neglect of value theory in macro-models is of no consequence. However, the phenomenon now usually described in terms of the "Phillips curve" emphasizes that the structural characteristics of an economy have important implications for macroeconomic policy. Conventional macroeconomic models are not equipped to handle these problems since they are almost always designed with the simplest type of structure on the supply side; i.e., they generally postulate that all the needs of the economy may be met by one versatile commodity which may either be consumed or invested.[1]

This paper explores the process of income determination and relative price determination using a two-factor, two-commodity model in an attempt to shed light on the problems of designing Keynesian-type employment policies in an economy where relative prices are variables. Specifically, the model follows the two-sector growth models of Meade [5], Uzawa [7], Inada [4], Corden [2], and others in matching the Keynesian distinction between consumption and investment on the demand side with a distinction between consumption and investment goods on the supply side.

In spite of the similarities between our model and the two-sector growth models, we should stress that the analysis is essentially static since our main interest is in the problems surrounding employment policy in the short term. Accordingly, we ignore the effect of current investment on the capital stock and take both the capital stock and the labor supply (the maximum possible labor service available per period) as given. Depreciation is assumed to be zero.[2]

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[1] This is true even of Patinkin's *Money, Interest, and Prices* [6], which sets out to integrate value and monetary theory but which nonetheless allows for no variations in relative commodity prices. Ackley's textbook [1, Chap. 20] is one of the few dealing at any length with the problems raised by modifying the "one-good" assumption.

[2] The assumption of fixed factor endowments could be replaced by one in which factor sup-

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The paper proceeds via the construction of a familiar two-commodity, two-factor supply model, through the analysis of the demand side, to a consideration of the relationships between movements of relative prices and policies designed to achieve full employment. For convenience we use, wherever possible, the notation of the two-sector growth models.

I. *The Supply Side*

We assume two production functions relating capital (K) and labor (L) to output, for each of the commodities, investment good (I) and consumption good (C)

$$C = F_o(K_o, L_o); \qquad I = F_i(K_i, L_i)$$

where the subscripts identify the type of production in which the variables are involved. We shall assume that these are linear homogeneous functions and hence may write them as

$$C = L_o f_o(k_o); \qquad I = L_i f_i(k_i)$$

where

$$k_o = K_o/L_o \quad \text{and} \quad k_i = K_i/L_i.$$

We also define total capital and labor used as

$$K = K_o + K_i \leqq \overline{K}; \qquad L = L_o + L_i \leqq \overline{L}$$

where $\overline{K}$ is the total capital stock and $\overline{L}$ is the total supply of labor services. From these definitions we may derive

$$k = K/L = \frac{K_i + K_o}{L}$$

$$= \rho_i k_i + (1 - \rho_i) k_o$$

where $\rho_i = L_i/L$ and $(1 - \rho_i) = L_o/L$.

Marginal rates of substitution between capital and labor in each sector may be written as

$$\mu_c = - \left[\frac{f_c}{f'_o} - k_o \right], \mu_i = - \left[\frac{f_i}{f'_i} - k_i \right].$$

Assuming perfect competition we have producers in equilibrium where $\mu_o = \mu_i = -\omega$, where ω is the wage/rental ratio. This equation defines a contract curve in the familiar box diagram with sides equal to K and L. If we are on this curve, the negative of the marginal rate of substitution

plies are elastic with respect to factor prices. We have not explored the implications of this assumption since we wish to concentrate on the effects of introducing two commodities into a set of assumptions which is otherwise fairly typical of those used in static macroeconomic models.

between investment goods and consumption goods may be defined as:

$$\alpha \equiv \frac{f'_i}{f'_c}$$

which, of course, refers to the slope of the production possibility frontier for C and I derived from the contract curve in the box diagram. Since we wish to allow values of $K \leq \overline{K}$ and $L \leq \overline{L}$, we may envisage many Edgeworth production boxes inside the full employment box and, similarly, many production possibility frontiers inside the full employment frontier.

Thus four equations sum up the supply side of the model:

$$k = \rho_i k_i + (1 - \rho_i) k_c \tag{1}$$

$$\omega = (f_i/f'_i) - k_i \tag{2}$$

$$\omega = (f_c/f'_c) - k_c \tag{3}$$

$$\alpha = f'_i/f'_c \tag{4}$$

Taking differentials of equations (1) to (4) we get:

$$\begin{bmatrix} \rho_i & 1 - \rho_i & k_i - k_c & 0 \\[2ex] -\dfrac{f_i f''_i}{(f'_i)^2} & 0 & 0 & 0 \\[2ex] 0 & -\dfrac{f_c f''_c}{(f'_c)^2} & 0 & 0 \\[2ex] \dfrac{f''_i}{f'_c} & -\dfrac{f'_i f''_c}{(f'_c)^2} & 0 & -1 \end{bmatrix} \begin{bmatrix} dk_i \\[2ex] dk_c \\[2ex] d\rho_i \\[2ex] d\alpha \end{bmatrix} = \begin{bmatrix} dk \\[2ex] d\omega \\[2ex] d\omega \\[2ex] 0 \end{bmatrix} \tag{5}$$

whence

$$dk_i = -\frac{(f'_i)^2}{f_i f''_i} d\omega \tag{6}$$

$$dk_c = -\frac{(f'_c)^2}{f_c f''_c} d\omega \tag{7}$$

$$d\rho_i = \frac{dk}{k_i - k_c} + \frac{1}{k_i - k_c} \left[\rho_i \frac{(f'_i)^2}{f_i f''_i} + (1 - \rho_i) \frac{(f'_c)^2}{f_c f''_c} \right] d\omega \tag{8}$$

$$d\alpha = \frac{(f'_i)^2}{f_i f_c} \left[\frac{f_i}{f'_i} - \frac{f_c}{f'_c} \right] d\omega$$

$$= \frac{(f'_i)^2}{f_i f_c} (k_i - k_c) \, d\omega \text{ from (2) and (3)} \tag{9}$$

Thus for constant ω we have constant k_i, k_o and α. Also, using the normal assumptions about the production functions ($f_i > 0, f_i' > 0, f_i'' < 0$, and the same for f_o and its derivatives) we have $dk_i/d\omega > 0$, $dk_o/d\omega > 0$, and $d\alpha/d\omega \gtrless 0$ for $k_i \gtrless k_o$.

II. *The Demand Side*

Full Employment Equilibrium with a pre-Keynesian Demand Function. If we were to adopt conventional two-commodity general equilibrium analysis, we could describe the demand side of the model in terms of
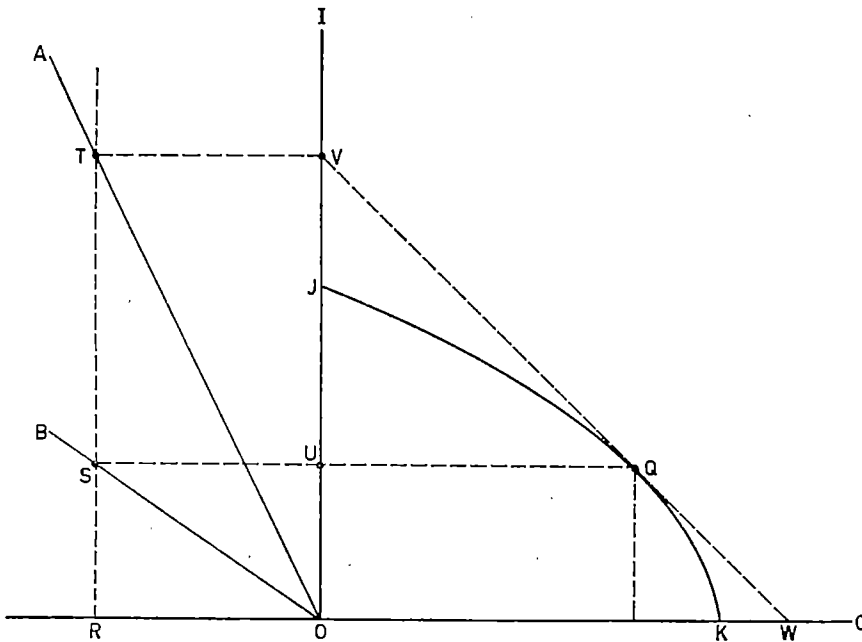
FIGURE 1

convex-to-the-origin community indifference curves. Full employment equilibrium would then imply tangency between one of these curves and the production possibility frontier for $K = \overline{K}$, $L = \overline{L}$. In such a model the demand for investment goods and the demand for consumption goods would each depend on the commodity price ratio, $p \equiv p_c/p_i$, and the level of national income (i.e., demands would depend on the slope and position of the aggregate budget line in a diagram such as Figure 1).

Assume, then, that the money demand for consumption goods is a constant proportion, c, of the value of national income, and the value of demand for investment goods is a residual proportion, $1 - c = s$, of the value of output. (The assumption of a constant s is a convenient and familiar one which we shall retain in the following sections.) Preferences,

then, are such that, in equilibrium, we must have

$$\frac{p_oC}{p_iI} = \frac{1-s}{s}$$

which may be written as

$$p = \frac{(1-s)I}{sC}.$$

The marginal rate of substitution between investment and consumption goods (in use) may then be written as $-\beta$ where

$$-\beta \equiv \frac{-(1-s)I}{sC} = \frac{dI}{dC} \tag{10}$$

or, since we assume s is constant,

$$-s\int \frac{dI}{I} = (1-s)\int \frac{dC}{C}.$$

which integrates to give the Cobb-Douglas community preference function

$$W = I^sC^{1-s} \tag{11}$$

where W, the constant of integration, is some indicator of community preference.

Given this preference function, full employment equilibrium will occur when one of the indifference curves is tangential to the full employment production frontier. It is apparent from equations (4) and (10) that equilibrium requires

$$\alpha \equiv \frac{f_i'}{f_o'} = \frac{(1-s)I}{sC} \equiv \beta = p \tag{12}$$

In Figure 1 the two rays OB and OA divide any vertical line in the northwest quadrant in the ratio $(1-s)$ to s. Thus $ST/RS=(1-s)/s$. If we locate V on the vertical axis horizontally opposite T, and from V draw the tangent to the production frontier JQK at Q, we have a simple method of testing whether the p value implied by the slope of VW is consistent with equation (12). Thus if Q is horizontally opposite S, the equilibrium value of p has been found; i.e., one of the indifference curves must touch the frontier at Q. In terms of equation (12) we have

$$\alpha \equiv \frac{f_i'}{f_o'} = \frac{UV}{UQ} = \frac{UV}{OU}\cdot\frac{OU}{UQ} = \frac{ST}{RS}\cdot\frac{OU}{UQ} = \frac{1-s}{s}\cdot\frac{I}{C} \equiv \beta = \frac{OV}{OW} = p$$

Given our assumptions about supply and demand conditions Q will be a unique equilibrium.

Demand Functions in the Keynesian Sense. It is clear that the Keynesian analysis of demand is not of the kind summarized in equation (11). In the simplest versions of the Keynesian theory we find that the demand for investment goods depends on the rate of interest and the schedule of the marginal efficiency of capital, while the demand for consumption goods depends chiefly on the level of income. This means that we can no longer use equation (11) as a demand function covering both consumption and investment goods, since that equation would imply that the real demand for investment would, by definition, be equal to the real value of savings in terms of investment goods, irrespective of the slope and position of the national income budget line: hardly a Keynesian assumption. In the following discussion we shall retain equation (11) as the community's preference function for consumption goods and consider the implications of a Keynesian investment function. The analysis of Figure 1 may be retained since, with constant s, the point Q is still the only one consistent with full employment and an equality of planned and actual consumption. At any other value of p than that implied by VW producers would choose to produce a quantity of consumption goods different from that desired by consumers. If we now assume that real investment demand is autonomous with respect to income and relative prices, Figure 1 still indicates that full employment equilibrium requires real investment demand to be equal to OU; i.e., the amount consistent with what we shall call "consumption-saving" equilibrium at Q. However, Keynesian theory would assert that there are no automatic forces setting investment demand at this level.

III. *Relative Commodity Prices and the Multiplier*

The model under discussion confirms the necessity of assuming relative commodity prices to be constant if standard Keynesian prescriptions are to be appropriate. For example, if a movement from an under full employment equilibrium to the full employment frontier requires a change in the relative price of consumption and investment goods, it is necessary to modify the formula for the static investment multiplier. Appropriate alterations have been given by R. A. Gordon [3] in connection with his observation of an upward trend in the price of capital goods relative to the price of consumption goods in the U.S.A. and several other countries. Gordon's paper is, however, limited to the extent that it discusses changes in relative commodity prices while at the same time it assumes a composite commodity, Y, produced by one

FIGURE 2

aggregate production function.[3] Changes in relative prices cannot then be related to changes in relative production costs as they may be in a model which is "two-sector" on both the supply and the demand side. These relationships will be considered in Section IV. The remainder of this section is concerned with an interpretation of the problem of designing the "injection" of real investment expenditure appropriate to the achievment of full employment, in the context of the type of construction used in Figure 1.

In Figure 2 we begin by leaving aside all considerations about production conditions and simply assume a Keynesian under full employment equilibrium at V, which lies inside the full employment frontier. The commodity price ratio is assumed to be historically given as in most versions of the Keynesian analysis. Given this price ratio, and s, the radial expansion path OE indicates the consumption function. With national income at the level indicated by Y_1Y_1, the demand for consumption goods is OA and the value of saving in terms of investment goods OB. If the autonomously given demand for investment goods is also OB, we have income in equilibrium; i.e., equilibrium is determined at the intersection of OE and the autonomous investment schedule BB'*. As BB' shifts up or down, its intersection with OE indicates, for

[3] This interpretation of Gordon's work is based on pages 949 to 954, and footnote 25, page 954 [3].

constant relative commodity prices, new levels of income at which planned saving equals planned investment.[4]

Now let us suppose that the change in real investment BD has been selected by the government in an attempt to reach full employment. Such a change is in accord with conventional multiplier analysis.[5] That is, it is the change in autonomous investment expenditure which, given the relative price ratio, would place the economy on the full employment frontier at the point Z. But while Z is on the frontier, it may not be an equilibrium point. This may be illustrated by considering the full employment production frontier passing through Z. With the existing commodity price ratio, perfectly competitive producers would, in full employment, choose to produce the combination at W, to the right of Z, where the slope of the frontier equals the given price ratio. But production at W would not, of course, be consistent with consumption-saving equilibrium, for consumers would then choose point T.

In fact, as we know from Figure 1, there is only one price ratio consistent with equilibrium, and that is given in Figure 2 by the slope of the frontier at Q which must lie between Z and W.[6] Any discrepancy between Q and Z implies that the proper specification of a full employment program should allow for an adjustment of the commodity price ratio, which in turn implies that the required adjustment of autonomous investment demand must be different from the amount needed in the case where Q and Z coincide; i.e., where the commodity price ratio is already, in the under full employment equilibrium, appropriate to full employment equilibrium. This last case must presumably be taken as the one implicit in those discussions of employment policy which take relative prices as given.

Figure 2 may be used to illustrate the historical data with which Gordon was concerned. Thus we may imagine that some historical frontier is tangential to Y_1Y_1 at V. In the course of time the economy moves from V to Q where the price ratio reflects a higher price of invest-

[4] For a discussion of multiplier analysis in terms of this type of diagram, see [8].

[5] Thus the "process" analysis of the multiplier, assuming a one period consumption lag, would presumably be represented by the diminishing zigzag movement V, a, b, c, d, e, etc. The injection BD, sustained through successive periods, leads to diminishing increments of consumption expenditure equal to ac, ce, etc. Some of the difficulties hidden in conventional macroeconomic models are exposed when multiplier analysis is considered in relation to the supply side of a two-sector model. Thus in Section V, it will become clear that, with fixed relative prices, completion of the path through points a, c, e, etc., in Figure 2 is not consistent with marginal cost pricing.

[6] That Q lies between Z and W may be seen as follows. A Cobb-Douglas indifference curve is tangential to the income line Y_2Y_2 at Z. This indifference curve must therefore cut the production frontier at Z from above so that the tangency point Q between the frontier and a convex-to-the-origin indifference curve must lie to the right of Z. At point Q, the slope of the frontier is necessarily less than that of Y_2Y_2 at Z. Hence the frontier will have a slope equal to Y_2Y_2 to the right of Q, at W, because of the concavity of the frontier to the origin. Hence Q lies between Z and W. Alternatively, if the frontier at Z were steeper than Y_2Y_2, we would find the point Q to the left of Z on the frontier and W further still to the left.

ment goods in terms of consumption goods. If, following Gordon, we write the income equilibrium condition as $\bar{p}Y_R = p_cC + P_iI$, where $\bar{p}$ is a price index and Y_R is real income, and if we retain our assumption that $p_cC/\bar{p}Y_R = c = $ constant, then the change in real income between V and Q may be measured as

$$\Delta Y_R = \frac{p_i\Delta I}{\bar{p}(1 - c)} \tag{13}$$

Hence the income generating potency of the injection $\Delta I = GQ$ in Figure 2 has been raised by the increase in the relative price of investment goods. Another way of putting this would be to say that the consumption function has the price ratio as a parameter, so that the change in income between V and Q is really the result of an increase in investment of GQ and a downward swing of the consumption function OE such that it passes through Q.

How are we to interpret equation (13)? As a guide to policy, suggesting that forecasts of changes in relative prices should be allowed for when planning for full employment? Or as a relationship implicit in any *ex post* comparison of two production levels such as V and Q, both of which could conceivably entail full employment? Both interpretations are possible. However, the second interpretation is related to questions which are better handled with two-sector growth models. In the remainder of this paper we shall be concerned with the problems which arise on the supply side of our static model from the attempt to achieve, by Keynesian expansionary measures, a move from, for example, V to Q in Figure 2.

IV. *The Limits of Proportional Expansion*

We begin again with the assumption that the economy is in equilibrium in Figure 2 at V, with the commodity price ratio given as a historical legacy. We now assume also that factor prices are inflexible downwards. It appears that expansion could occur without exerting any pressure on ω, the wage/rental ratio. If we take ω to be constant, equations (6), (7), and (9) tell us that k_i, k_c and α remain constant. Let $\bar{w}$ and $\bar{\alpha}$ be the unemployment equilibrium values of ω and α. In unemployment equilibrium, assuming that the perfectly competitive marginal cost pricing rule is adhered to, we have planned saving equal to planned investment, and $p = \beta = \bar{\alpha}$. In effect then, we imagine that producers are using those amounts of capital and labor which produce a "frontier" tangential to Y_1Y_1 at V.

If we now suppose that the government acts to expand autonomous investment demand and assume an instantaneous multiplier, the economy will expand along the ray OE. This follows from the fact that,

with ω and hence α constant, we must move along an expansion path such that $\alpha = \beta = $ constant if income equilibrium as defined in equation (12) is to be maintained. With constant s this path implies a constant I/C ratio. Given our assumption of linear homogeneous production functions this implies that $dk = 0$ and hence, from equation (8) $d\rho_i = 0$.[7] If the constant value of k is different from the ratio of total available capital ($\overline{K}$) to total available labor ($\overline{L}$), a point must be reached where one of the factors is fully employed while there are surplus supplies of the other still available. This point corresponds to the boundary of the production possibilities area of a fixed coefficient model with k_o and k_i at their unemployment equilibrium values.[8] We may find the limits of proportional expansion in the present model by finding the separate capital and labor restraint equations for given k_o and k_i and given $\overline{K}$ and $\overline{L}$.

With linear and homogeneous production functions we have, associated with a given pair of k_o and k_i values (determined by $\bar\omega$), a pair of labor input-output coefficients, $1/f_o$ and $1/f_i$, and a pair of capital coefficients, k_o/f_o and k_i/f_i. From these we may form the budget equations appropriate to the budget constraints $\overline{L}$ and $\overline{K}$.

$$\overline{L} = \frac{1}{f_o} C + \frac{1}{f_i} I \tag{14}$$

$$\overline{K} = \frac{k_o}{f_o} C + \frac{k_i}{f_i} I \tag{15}$$

where the first equation shows C and I combinations which exhaust $\overline{L}$ and the second combinations which exhaust $\overline{K}$. Solving each equation for I produces the following restraint equations:

$$\text{Labor:} \quad I = \overline{L} f_i - \frac{f_i}{f_o} C \tag{16}$$

$$\text{Capital:} \quad I = \frac{\overline{K}}{k_i} f_i - \frac{f_i k_o}{f_o k_i} C \tag{17}$$

where the relationship between the slopes is dependent on the relative capital intensities. If the economy is producing at the intersection of the two linear restraint lines, we have both factors fully employed and are also satisfying the production equilibrium condition $\mu_o = \mu_i = -\bar\omega$. Thus we must be on the full employment frontier with the slope of the

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[7] The expansion of production thus involves equiproportionate expansion of the sides of the Edgeworth production boxes corresponding to the amounts of the factors actually in use, and radial expansion of the related production frontiers.

[8] For a discussion of fixed coefficients in the context of a two-sector growth model see Corden [2].

frontier equal to $-\bar{\alpha}$; i.e., the intersection point must be one such as the point W in Figure 2, where the frontier's slope corresponds to the α appropriate to the unemployment equilibrium of point V.[9]

It now appears that the case we have considered in Figure 2 is only one of many possibilities which in the context of our model we may conveniently group into four classes. Let a ray through Q in Figure 2 divide the production possibility area into Zone I, where I/C values are greater than at Q, and Zone II, where I/C values are less than at Q. Unemployment equilibrium may lie in Zones I or II or on the boundary between them. If we begin in Zone I, proportional expansion along a ray such as OE in Figure 2 must bring us against the capital restraint line before we reach the frontier at Z if $k_i > k_o$, and against the labor restraint line if $k_i < k_c$. These results follow from equations (16) and (17). If we begin in Zone II, proportional expansion would bring us against the labor restraint if $k_i > k_o$ and against the capital constraint if $k_i < k_o$. Thus proportional expansion exhausts first whichever factor is relatively intensively used in the industry towards which the economy is biased. If we begin on the boundary between the zones proportional expansion exhausts both factors simultaneously.[10]

In our final section we attempt to answer the question which now seems to suggest itself: Will the pressures created in factor and/or product markets, by the possible exhaustion of proportional expansion opportunities prior to full employment of all resources, necessarily produce changes in relative prices appropriate to the achievement of full employment equilibrium?

V. *Factor Restraints and Relative Price Adjustments*

In the four panels of Figure 3 we illustrate the four cases defined in the preceding section and may pose our question in terms of the consequences for relative prices of striking restraint lines at the four points labeled R_1, R_2, R_3, and R_4.

When a restraint is struck we always have some distance between the relevant R and Z points. In such cases the possibility of achieving full employment in a perfectly competitive model depends on the restraint lines themselves responding to the exhaustion of one of the factors at the four R points in such a way as to "open a path" to full employment

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[9] From equation (4), using (2) and (3), we have

$$\alpha = \frac{f_i(\omega + k_o)}{f_o(\omega + k_i)}$$

and this shows that the slope of the frontier at the intersection of the two restraint lines is between the slopes of these restraint lines, as is shown in Figure 3(a) below at W_1, where LL' and KK' are the restraint lines.

[10] In the case where $k_i = k_o$, equations (16) and (17) coincide with the production possibility frontier.

FIGURE 3

of both factors. It is possible to argue that such a relaxation of the restraints is likely.

Let us assume that hitting a restraint line causes the price of the now fully employed factor to rise relatively. The capital constraint, effective in Figures 3(b) and 3(c), will then cause the wage/rental ratio to fall, whereas the labor restraint (Figures 3(a) and 3(d)) will cause it to rise.[11] Thus if we strike the capital restraint line the capital input-output coefficients in equation (15) will be reduced by factor substitution to the level appropriate to the lower wage/rental ratio, while the labor coeffi-

[11] It will be recalled that we have followed the typical assumption that factor prices are inflexible only in the downward direction. It should be noted that the main conclusions of this paper apply even if it is assumed that the whole burden of unemployment falls on labor. This simply means that the unemployment equilibrium point in Figure 3 will always be on the KK' lines.

cients in (14) will rise. Consequently the intercept-values of the capital restraint lines in Figures 3(b) and 3(c) will increase (pushing the restraint lines out from the origin) while those of the labor restraint lines will decrease. Repeated "nudging" of the capital restraint line would thus appear to open the way to full employment of both factors. By similar arguments, if we strike the labor restraint line, increases in ω lead to reactions on the supply side such that the labor restraint line recoils from the push. Another way of putting this is to say that supply reactions to changes in ω cause the R and W points in the four panels of Figure 3 to converge on Q.

Thus there does appear to be the possibility that paths to equilibrium such as the dotted paths in Figure 3 will exist, along which $\alpha=\beta$ at all points. The path from R to Q in each case would presumably be unique. This may be seen as follows: The movements of the restraint lines cause point W to move towards Q. For each position of W we have the new α value given by the slope of the frontier at W. We then find that point on the operative restraint line (the one being nudged) where this α value coincides with β, which, given equation (11), varies monotonically as we move along a linear negatively sloped restraint line.

Presumably the $\alpha=\beta$ paths could be followed if the indifference map was, as we assumed initially in Section II, one which described demands for both types of goods. But, once again, we encounter difficulties when we try to allow for a Keynesian investment demand function. For even if we assume, as we have been doing in proposing the proportional expansion along the rays through the V points, that the government has effectively taken over the management of the level of planned investment demand, paths such as those from R to Q pose greater problems than those posed by merely proportional expansion. Thus the movement from R to Q involves managing investment demand through the values indicated by points on the I-axis horizontally opposite points on the $\alpha=\beta$ paths. Unless this occurs we shall have excess demands or supplies for investment goods, as the case may be, with the resulting changes in the commodity price ratio pushing the economy off the $\alpha=\beta$ path. Furthermore the management of investment demands may require raising and then reducing real investment demand, if a movement from V through R to Q is to be achieved, since it is possible that Q lies below and to the right of R in situations where we begin in Zone I (Figures 3(a) and 3(b)). Such maneuvers, with their "go-stop" implications, may not be to the taste of the investment-good industry if it is anxious to retain its relative importance in the economy. Similarly, if V is in Zone II, R may be to the right of Q, so that the path to full employment may involve disagreeable ups and downs for the consumption-good industry. It is clear that the problems of managing investment-

type "injections" to a level suitable to full employment may be much more complex than macroeconomic models which ignore relative commodity prices suggest. In particular, the convenient picture of a stable equilibrium which emerges from the standard 45° diagram of the macroeconomic textbooks becomes blurred when we consider even the relatively simple extension of the model to two separately specified production sectors.

REFERENCES

1. G. Ackley, *Macroeconomic Theory* (Macmillan, 1961).
2. W. M. Corden, "The Two-Sector Growth Model with Fixed Coefficients," *Rev. of Econ. Studies*, July, 1966.
3. R. A. Gordon, "Differential Changes in the Prices of Consumers' and Capital Goods," *A.E.R.*, Dec., 1961.
4. K. Inada, "On a Two-Sector Model of Economic Growth: Comments and a Generalisation," *Rev. of Econ. Studies*, June, 1963.
5. J. E. Meade, *A Neo-Classical Theory of Economic Growth* (London: George Allen and Unwin, rev. ed., 1962).
6. D. Patinkin, *Money, Interest, and Prices* (Harper and Row, 2nd ed., 1965).
7. H. Uzawa, "On a Two-Sector Model of Economic Growth: I," *Rev. of Econ. Studies*, Oct., 1961, and Part II, same journal, June, 1963.
8. L. R. Webb, "A Further Diagrammatic Illustration of Properties of the Keynesian Income Equilibrium," *Economica*, Nov., 1961.

THE DEMAND AND SUPPLY OF SECURITIES AND ECONOMIC GROWTH AND ITS IMPLICATIONS FOR THE KALDOR-PASINETTI VERSUS SAMUELSON-MODIGLIANI CONTROVERSY*

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The Keynesian revolution is usually thought to have begun with the *General Theory of Employment, Interest, and Money* [16, p. ix] [7, p. 462]. According to Keynes's biographer, however, the *General Theory* emerges from Keynes's attempt to simplify the intricate analysis of his *Treatise on Money* [7, p. 437]. It is the *Treatise* (hereafter referred to as TM) rather than the *General Theory* (hereafter GT) which is Keynes's "most mature work," "the work of a lifetime," and the one where the student will "get the best picture of his [Keynes's] total contribution to economics" [7, p. 403].

Admittedly, Keynes's fundamental "law" on effective demand is developed extensively only in the GT, and one can readily agree with Klein that "the revolution was solely the development of the theory of effective demand" [16, p. 56]. Nevertheless, it may be argued that the liquidity preference theory of 1936 represents a retrogressive movement from the monetary analysis of the TM, where, in the latter, Keynes's "views about all the details of the complex subject of money are . . . to be found" [7, p. 403]. As Sir Roy has lamented, "it is a paradox that the man whose world-wide fame during most of his lifetime arose from his specific contributions to monetary theory, which were rich and varied, should be studied mainly in one of his books which contains little about money as such" [8, p. 442].

It is also a sorry fact that in the post-Keynesian literature the role of money in the growth models has too often been ignored. Moreover, the relationship between money and growth is likely to continue to be misunderstood so long as modern Keynesian monetary analysis is based solely on Keynes's 1936 work. The essence of growth is dynamic change, and Harrod has pointed out that "the *Treatise* is more dynamic than the latter volume" [7, p. 433]. In the TM, we only "get an analysis of the economy when it is out of equilibrium and in a state of movement . . . ." [7, p. 457]. Robinson [22, p. 56] and Klein also note that the TM emphasis is on movement and dynamics [16, p. 28]. It is my belief, therefore, that a more solid advance in understanding of the

money-securities-economic growth nexus can be made by judiciously mixing elements of Keynes's 1930 monetary analysis with his 1936 classic approach to the principles of effective demand.

Some of the confusion which hitherto has prevented the combining of the analysis of the TM with the concepts of the GT can be eliminated by some recourse to microeconomic concepts. For example, the Marshallian stability conditions, at any given output level, can be identified with the earlier work, while the Walrasian stability conditions, at any given supply price, can be the interpretative key to the later volume. If, in the TM, one substitutes the Marshallian concept of demand price for the term "investment," and supply price for "savings," the terminological turmoil arising from Keynes's discussion of the inequality of savings and investment is readily resolved. Thus, to recall the argument of the TM, when investment exceeds (is less than) savings—i.e., the demand price, D_p, exceeds (is less than) the supply price, S_p, which includes normal profits at a given level of output, Q_1, as in Figure 1a— then, in the market period, transactions occur at the demand price of p_1. This results in windfall profits (losses) as revenues exceed (fall short of) normal supply requirements. The invisible hand of the marketplace, operating via these windfall profits (losses) encourages entrepreneurs to expand (contract) output and employment. It is the analysis of the factors which lead to a discrepancy between D_p and S_p which bring about the dynamic change in prices and subsequently output in the TM.

In the GT, on the other hand, Walrasian stability conditions are implicitly utilized. If *ex ante* investment exceeds (is less than) *ex ante* savings, then the demand quantity, D_q, exceeds (is less than) the supply
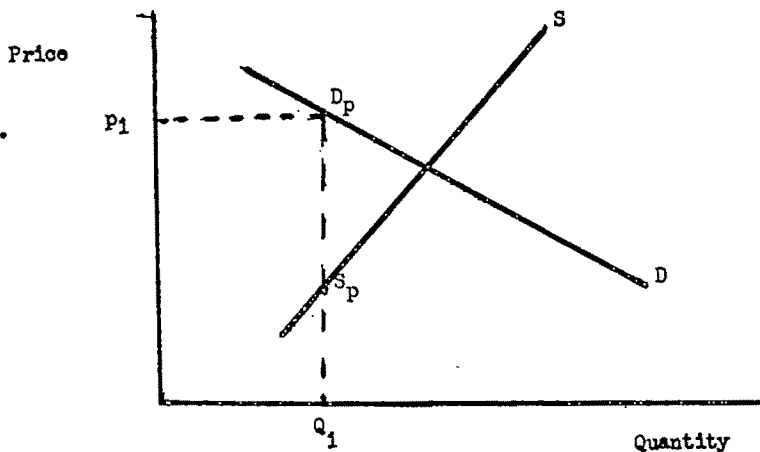
FIGURE 1a
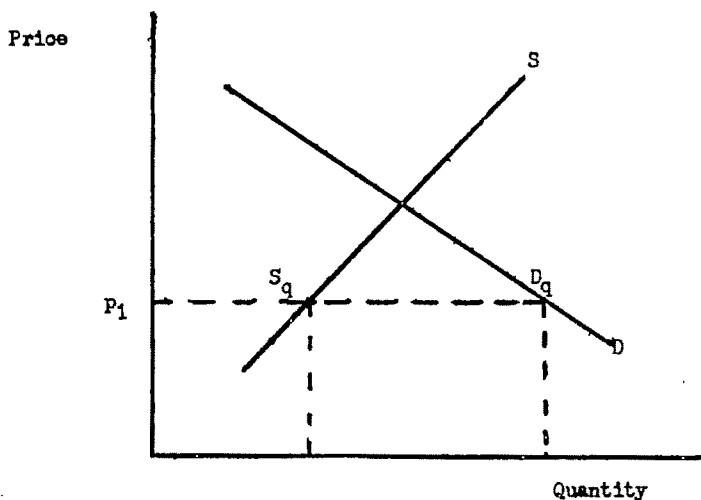
Price

FIGURE 1b

quantity, S_q, at the given supply price of p_1, as in Figure 1b. Market transactions occur at the price of p_1, and the demand quantity of D_q is sold, while production is equal to the supply quantity, S_q, as inventories are drawn down. Entrepreneurs, reacting to the involuntary reduction (increase) in inventories caused by the invisible hand, are induced to expand (contract) output (cf. [23, pp. 223–24] [7, p. 456]). Since in this latter case, the market price is equal to the supply price—which is easily translated into wage units—for the given level of output and employment, these can be no windfall profit or loss on current production. Consequently, actual savings must always equal actual investment as unplanned inventory changes play the role which windfall profits did in the TM.[1]

With the GT, however, a more subtle change in view is imparted through the adoption of the Walrasian conditions than merely the simple transfer in concept from demand and supply prices to demand and supply quantities.[2] Perhaps due to the persuasion of the friendly

[1] Keynes attempted to justify the change in emphasis from windfall profits to unintended inventory changes as being more realistic [15, p. 51, n. 1].
[2] Modern neo-Keynesians, despite similarities in their growth models, are deriving their analysis from different Keynesian sources. Kaldor [9] and Pasinetti [18] are utilizing Marshallian D_p and S_p conditions with market transactions occurring at D_p (at full employment). Since Kaldor essentially utilizes demand prices as the market-clearing mechanism in his growth model, he can say "I am not sure where 'marginal productivity' comes into all this" [9, p. 100]. Productivity is relevant for the supply price and not the demand price. Joan Robinson, on the other hand, is emphasizing the supply price aspect of Walrasian conditions in her analysis of the rate of profit in economic growth [21, pp. 10ff.]. Thus, despite many similarities in the Kaldor-Pasinetti and Robinsonian Cambridge varients of growth models, there remains important differences. For example, the Robinson analysis is much more involved with the relationship of technology, the money wage, and profit margins (the degree of monopoly) to "normal" (i.e., supply) price [e.g., 21, pp. 7, 10, 17, 29, 36–37, 41, 45, 47, 70–74, 77–78, 120–21]. These items are virtually ignored in Kaldor-Pasinetti type growth models.

coterie surrounding Keynes at Cambridge, the 1936 volume is geared primarily to the establishment of a stable equilibrium with less concern for the forces promoting dynamic movement [7, p. 457] [22, p. 56]. Subsequent mathematical formulation of the Keynesian model has accentuated the tendency to suppress the earlier features of dynamism in their concentration on the simultaneous solution of the equations of the system. The equilibrium position rather than the mechanism of change has become the characteristic post-Keynesian analysis.

If Harrod is correct in arguing that Keynes had concluded that his critics "simply failed to grasp" [7, p. 435] the complexities of the 1930 analysis, then it is reasonable to believe that the GT was the result of a search for a "simplification" [7, p. 437]. If the main breakdown in communication between Keynes and others was on the principle of effective demand, then it is not surprising that although "money enters into the economic scheme in an essential and peculiar manner, [Keynes purposely fitted] technical monetary detail . . . into the background"[3] [15, p. vii].

If Keynes's real contribution was "to show that if savings are not offset by legitimate investment outlets, failure to generate a high level of employment will follow" [13, p. 81], then in winning the battle of Say's law in his 1936 volume, Keynes may have underplayed the complexities of monetary market phenomena through an oversimplified monetary analysis.

Actually, Ohlin, with D. H. Robertson always (for company) in pursuit, was quick to seize upon the deficiencies of the truncated monetary analysis of the GT [17] [20]. Under their hammering, Keynes was forced to retreat and confess the incompleteness of his work in a series of exchanges in the *Economic Journal* [13] [14]. As Keynes had already developed a more powerful and complete monetary analysis in his TM, however, he was immediately able to moderate his liquidity preference argument to encompass the needs of finance, and thereby enjoin his critics with what he characterized as the "coping-stone of the liquidity theory" [14, p. 667]. In essence, Keynes was merely restoring the theory of bearishness and the demand for capital goods as elaborated in the TM into consistency and orderliness with his liquidity preference apparatus.[4]

Rather than a coping stone, Keynes's 1937 finance motive discussion is the Rosetta stone which makes possible the deciphering of the ancient

[3] This evaluation of the relationship between the TM and GT finds support in Klein's remark that the liquidity preference theory was not an essential element of the GT: "It merely rounds out the theory and makes it complete . . . Keynes . . . remarked that, as it actually happened, he first conceived of the savings-investment equation [i.e., the excess demand equation] as the determinant of the level of output. This left him without a theory of interest; so he then developed the liquidity preference theory" [16, p. 43].

[4] Cf. Harrod's comments on Keynes's "remarkable" consistency in the development of his theories [7, pp. 467ff.].

TM hieroglyphics into modern post-Keynesian teminology. In attempting to analyze the role of money in the real, non-golden age, world of economic growth, I have become even more aware of the defects of the truncated monetary approach of the GT as against the perspicacity and elaboration of the TM's analysis of the interrelations of commodity and security markets, and the roles played by the various financial institutions which Keynes tends to dismiss as mere "technical detail" in the GT. Since the TM is an analysis of "an economy on the move," while the latter volume emphasizes static equilibrium,[5] much insight can be derived by restructuring the bearishness concepts of the TM with the more widely used classificatory scheme of the GT.

Given the deliberate ensconcement of detailed monetary analysis in the GT, it is not surprising that, thirty years after the Great Depression, the efficacy of monetary policy in promoting economic growth has been viewed, as Professor Samuelson points out, with skepticism by a significant portion of the academic "Keynesian" majority of the economics establishment [see 24, pp. 341–42]. Elsewhere I have already made some attempt at providing a simple model of capital accumulation [2] which blends the stock and flow elements in the demand and supply of (1) real capital, (2) money, and (3) securities (which are essential features of the analytical structure of the TM) with the more familiar principles and concepts of effective demand developed in the GT. Within such a framework it is possible to provide more perspective on the interplay among the organized security exchanges, corporate financing policy, investment bankers, and the banking system in channeling the financial funds necessary for capital accumulation. Regrettably this is an analysis which is virtually ignored in most "analytical" post-Keynesian models. That Keynes did not wish to ignore the financial market institutions is evident from the inclusion of Chapter 12 in GT. Nevertheless, he considered these aspects a "digression" which was "on a different level of abstraction from most of this book" [15, p. 149]. While the literary content of this chapter gets high marks for brillance, and the reader is struck by many telling phrases, the analytic portion is slim. No wonder discussions of financial institutions and their impact on

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[5] This is especially true when comparing the money market analysis of the two books. The stock approach to money of the GT makes the securities market appear to be in continuous static equilibrium. Observed security prices, on the other hand, are normally disequilibrium ones. The reader might engage in an interesting exercise if he tried to unravel the meaning of the four possible bull and bear markets which Keynes analyzes on pp. 252–54 of Volume I of the TM. (Hint: Disequilibrium is the essence in understanding the analysis of these bull and bear markets.) Moreover, if it was recognized by "Keynesians" that the money market may not always clear (as the *General Theory* leads one to believe), i.e., that there is a "fringe of unsatisfied borrowers" [12, Vol. 11, p. 365], then some of the controversy over whether the monetary authority should control solely the rate of interest (which does not necessarily clear the market) or whether they should control primarily the money supply itself could be clarified. If the object is to affect aggregate demand, and if the interest rate does not clear the market, the money supply is the more strategic policy variable for the monetary authorities.

the economy have flowed primarily from the pens of non-Keynesian scholars.

Now that over three decades have past, it is due time that Keynesian economists were weaned from the mollycoddling liquid of liquidity preference and imbided in the stronger distillations of the TM, including its real "non-golden" age disequilibrium approach to dynamic change.

The Two Cambridges Debate

In the time remaining, I should like to suggest a few of the general elements of a theory of security markets and apply it to a controversy which has recently engaged the scholars of Cambridge, England, and Cambridge, Massachusetts. In any complete macro-model, the real capital market can be developed in terms of stock and flow relationships which show that the growth in the stock of real capital depends primarily on entrepreneurial expectations of profits from the future flow of capital services, the rate of discount, the ability of entrepreneurs to obtain finance, the rate of capital depreciation, and the supply elasticity of the capital goods producing industries [see 2]. Because of space limitations in this paper, however, real investment will be taken as exogenously determined.

In our model, an analysis of household portfolio decision making based on the bearishness concepts of the TM and its relationship to corporate financing policies can be introduced to indicate that at least one aspect of the two-Cambridges debate—the Samuelson-Modigliani Anti-Pasinetti Theorem versus Kaldor's Neo-Pasinetti Theorem—is really a tempest in a teapot. This aspect of the altercation could have been avoided had both parties followed the TM approach which insists that the savings decision of households is not only independent of the investment decision of firms, but household savings decisions are, as a first approximation, independent of portfolio balance (or bearishness) decisions. As Keynes emphasized: "Although these [savings and bearishness] factors react on one another . . . [they] are independent in the sense that any degree, positive or negative, of the one is compatible in appropriate attendant circumstances with any degree, positive or negative, of the other" [12, Vol. 1, p. 145, also see pp. 141, 147].

The particular point in the two-Cambridge controversy which I will discuss involves the fact that Pasinetti developed a growth model which demonstrates "the irrelevance of workers' propensity to save . . . [while uncovering] the absolutely strategic importance for the whole system of the decisions to save of just one group of individuals: the capitalists" [18, p. 274]. Samuelson and Modigliani demonstrate, however, that if the savings propensity of worker households ($s\hat{w}$) is high enough, the workers end up doing all the accumulation, as the capitalists' house-

holds share of total wealth approaches zero [25, pp. 275-77]. Accordingly, the Samuelson and Modigliani proof, which they call the "Duality Theorem" but which Kaldor labels the "Anti-Pasinetti Theorem," appears to severely restrict the generality of the Cambridge, England, growth analysis. Consequently, Kaldor found it necessary to offer in rebuttal, a "Neo-Pasinetti Theorem," which presents some seminal ideas about the demand for securities in the context of economic growth.[6]

Essentially, Kaldor attempts to associate the net acquisition of financial assets by the personal (household) sector with net personal savings and the availability of finance for business investment. In Kaldor's words: "net savings out of income sets up a demand for securities, [and] net dis-savings out of income (= net consumption out of capital or capital gains) sets up a supply of securities. There is also a net supply of new securities issued by the corporate sector. Since, in the securities' market, prices will tend to a level at which the total (non-speculative) supply and demand for securities are equal, there must be some mechanism to ensure that the [consumption] spending out of capital (or capital gains) just balances the savings out of income *less* any new securities issued by corporations"[7] [10, p. 316].

Since Kaldor is discussing long-run golden age equilibrium, the balancing mechanism to which he alludes cannot be the level of output (Y) which by hypothesis is growing at the full employment rate over time. Instead, given the savings propensities, Kaldor suggests that—for any given volume of new issues by corporations—it is the level of security prices which equilibrates not only the demand and supply of securities but also the sum of net personal savings of households plus corporate retained profits with net investment in the system [10, p. 318].

The essence of Kaldor's position is given in the statement that "the net savings of the personal sector (available for investment by the business sector) will depend, not only on the savings propensities of individuals, but on the policies of the corporations towards new issues. In the absence of new issues the level of security prices will be established

[6] As footnote 2 suggests, Kaldor is deriving his analysis primarily from concepts of the TM. Consequently, it should not be surprising that Kaldor ultimately attempts to analyze the demand and supply of securities—an analysis which is specifically developed in the TM, but which is only implicit in the GT emphasis in the demand and supply of money. For some unexplained reason Samuelson and Modigliani ignore Kaldor's analysis in their reply [25]. It should be apparent that Kaldor-Pasinetti are presenting a model based solely on the demand price approach of the TM (at full employment), while Samuelson-Modigliani are offering a neoclassical productivity model based solely on supply price at full employment. Since productivity is not a determinant of demand price, once one recognizes Kaldor's demand price orientation, it is easy to understand why he exclaims, "I am not sure where 'marginal productivity' comes in on all this" [9, p. 100]. Samuelson-Modigliani, on the other hand, make productivity the essence of their system by emphasizing supply price.

[7] This must be regarded as an extension of views expressed over 28 years ago in Kaldor's analysis of "Speculation and Economic Stability." In that article, Kaldor argued that the price of bonds and shares are "largely determined" by speculative influences [11, pp. 42-44].

at the point at which the purchases of securities by the savers will be just balanced by the sale of securities by the dis-savers, making the net savings of the personal sector zero" [10, p. 318].

If accepted at face value, Kaldor's statement is truly a surprising *volte-face* Keynesian theory, especially since it is a Keynesian of Kaldor's stature who appears to be implying that given the distribution of income, given the level of net investment (I), and given the corporate new issue policy, the level of security prices (i.e., the rate of interest) will cause aggregate personal consumption to just fill the gap between the full employment level of output and investment spending. After all these years of verbal duels, acrimony, and clarification, Kaldor's analysis suggests that the rate of interest is the mechanism which ensures that effective demand is always maintained at the full employment level.[8] Kaldor, in his attempt to defend Pasinetti's neo-Keynesian analysis from the American neoclassical assault, has unwittingly reinstated the *deux ex machina* of the neoclassical system—the rate of interest—as the balancing mechanism, not only for maintaining equilibrium in the securities market, but also for ensuring a level of effective demand always ample to secure full employment.[9]

Fortunately for Keynesian economics, Kaldor's own analysis does not require this neoclassical mechanism once it is recalled that Keynes recognized—insisted really—that the household savings decision is distinct from the household portfolio balance or bearishness decision [12, Vol. 1, p. 141]. In fact if the terms portfolio, portfolio balance, and change in portfolios, respectively, are substituted for the words net savings, savings, and net savings when they appear in that order in the preceding quotation from Kaldor, then Kaldor's revised statement is simply a perceptive elaboration on Keynes, with some incisive implications on how traditional Keynesian mechanisms will restore equilibrium, with or without full employment as a precondition.

The Basic Relationships

The public's demand for securities (or placements) can be conceptualized as a stock demand for a store of value [12, Vol. 1, pp. 141–43, 248–51] and this can be written as

$$D_p = f_1(\rho, \lambda, \beta, \gamma, e, V) \tag{1}$$

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[8] Samuelson has, in a more jocular moment, referred to Jean Baptiste Kaldor [24, p. 345]. While I think this is scarcely appropriate, in the light of Kaldor's constant emphasis on full employment policy, there would be some point to the indictment if Kaldor really believed that the rate of interest induces consumption to fill the deflationary gap.

[9] This unintended result—if Kaldor's argument were valid—would do much to justify a witticism uttered some years ago by D. H. Robertson when he wrote: "Now as I have often pointed out to my students, some of whom have been brought up in sporting circles, high-brow opinion is like a hunted hare; if you stand in the same place, or nearly the same place, it can be relied upon to come round to you in a circle" [19, p. 81].
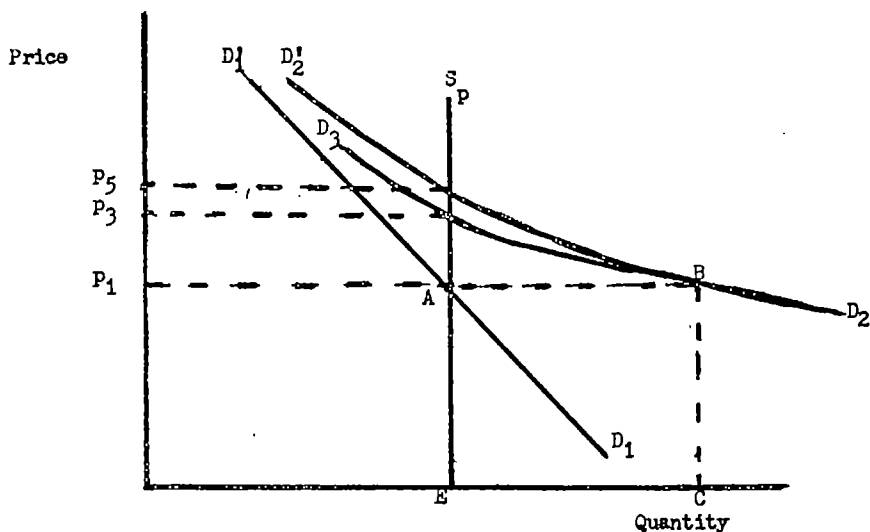
FIGURE 2

where D_p is the market demand for placements at any point in time, p denotes the market price of securities, λ is a set of expectations about the rate of change of future security prices, β and γ represent the public's aversion to income and capital risk, respectively, while e represents the number of wealth owners and the distribution of wealth among them, and V stands for the magnitude of the public's total store of value at any point of time. V is defined as the total of money balances held by savers as a store of value[10] (M_2) plus the total market value of placements held by the public at any point of time. This stock demand for placements, D_p, includes the Wicksteedian reservation demand for securities by the "bulls." Given λ, β, γ, e, and V, a demand curve for placements can be drawn as downward sloping D_1D_1' in Figure 2, i.e., $f_{1_p}' < 0$, since as the price declines, the expected capital gain from purchasing a security increases, while the (income) opportunity cost of holding money balances as a store of value increases. Hence the public will want to substitute placements for money holdings as the price of securities declines. Furthermore, every act of actual personal savings implies an increment in V and consequently an outward shift of the D_1D_1' curve (i.e., $f'_{1V} > 0$) in Figure 2. In line with his argument of a quarter century ago, Kaldor refers to this relationship between the demand for placements and changes in V as the nonspeculative demand

10 In the TM, Keynes associates money held as a store of value with saving deposits. Even in the GT, money-time deposits are included by Keynes in his definition of money [15, p. 167, n. 1], a definition which places Keynes much closer in spirit to Professor Friedman than to most "Keynesian" monetary theorists.
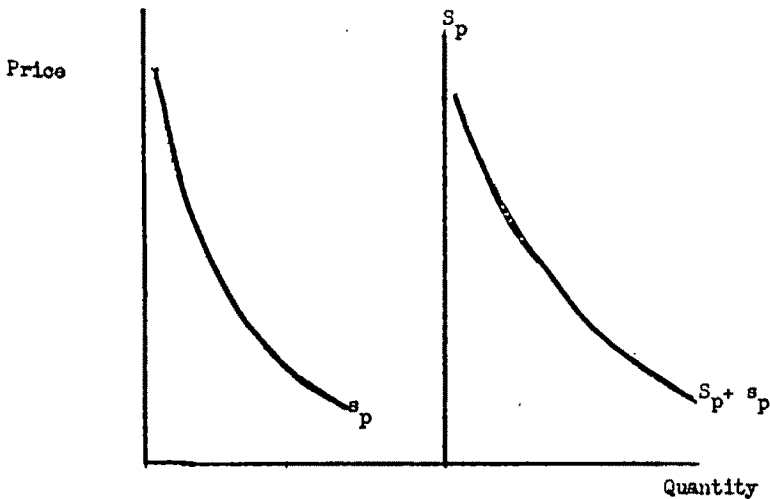
FIGURE 3

for securities (see [11, pp. 42, 48]). In the terminology of the TM, on the other hand, this shift in the demand curve for securities would be an increase in bullishness.

At any point in time, a given stock of outstanding securities exists as inherited from the past. Accordingly, the stock supply schedule of placements facing the public (S_p) is perfectly inelastic (in Figure 2 and 3) that is

$$S_p = \alpha \qquad (2)$$

where α is a predetermined constant. If there are no new securities issued by corporations, then an equilibrium price of p_1 will be established.

The unit of measurement of the quantity of placements runs in terms of the income per period to which ownership of a placement constitutes an absolutely certain claim [cf. 26, p. 21]. The use of a "certainty-income-claim" unit of measure signifies that, for our immediate purposes, we may ignore the varieties in market types of placements. Accordingly, "the rate of interest" is inversely related to the price of securities.[11]

Increases in the quantity of placements supplied will functionally depend on the entrepreneurial demand for investment goods and their demand for external finance to underwrite the investment. The flow

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[11] Of course, an increase in the probability of receiving an income claim would have the same effect as increases in "short sales" in the securities market. It may be viewed as an increase in effective supply. We shall ignore these problems in the following analysis since their introduction would make the analysis more complicated without altering the major conclusions.

supply schedule of placements can be specified

$$s_p = (igK)/p \tag{3}$$

where s_p designates the flow-supply of placements, and where, following Kaldor's symbols, i reveals the fraction of the firms' current investment (denoted by gK, where $K =$ capital, $g =$ growth rate) which corporations decide to externally finance via the issue of new securities to the public [cf. 10, p. 317]. Given i, g, and K, the flow supply schedule (s_p) with respect to the placement price, p, in any time period constitutes a rectangular hyperbola (see Figure 3).[12] The market supply schedule of placements in any period is obtained by summating equations (2) and (3); thus

$$S_p + s_p = \alpha + (igK)/p \tag{4}$$

The market supply curve, $S_p + s_p$, is the lateral summation of the stock-and flow-supply curves in Figure 3.

Kaldor's Neo-Pasinetti Theme

Returning to Kaldor's argument, maintenance of equilibrium in the securities market requires that any increase in the demand for placements must equal the quantity of new issues supplied by corporations plus the liquidation of securities by shareholders wanting to obtain active money balances to finance consumption out of capital gains. Thus Kaldor writes the equilibrium condition as

$$s_w W = cG + igK \tag{5}$$

where s_w is the wage earners' marginal propensity to save, W is the wage bill, and c is the fraction of capital gains (G) which stockholders wish to consume [10, p. 317].

At this stage, Kaldor is effectively assuming no savings out of profit distributions [10, p. 316] so that all capitalist savings is done by the firm. Most importantly, Kaldor states that "as far as my own ideas are concerned, I have always regarded the high savings propensity out of profits as something which attaches to the nature of business income, and not the wealth (or other peculiarities) of the individuals who own propery [sic]. It is the enterprise, not the particular body of individuals owning it at any one time, which finds it necessary in a dynamic world of increasing returns, to plough back a proportion of the profits as a kind of prior charge on earnings. . . . This is because (i) continued expansion cannot be ensured . . . unless *some proportion* of the finance required for expansion comes from internal sources. . . . Hence the high savings propensity attaches to profits as such, not to capitalists

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[12] Kaldor would associate the non-speculative supply of securities [10, p. 317] with our flow-supply schedule (see [11, p. 42]).

as such" [10, p. 310]. No wonder Kaldor and Pasinetti believe in the "absolute strategic" importance of the capitalists' propensity to save in the process of growth. This so-called "capitalists' propensity to save" is primarily a measure of corporate investment policy and the availability of finance rather than the savings behavior of particular households. Even the Cambridge, Massachusetts, neoclassicists cannot deny the "strategic" importance of actual investment expenditures on economic growth. Kaldor and Pasinetti are merely reminding us of the essentiality of finance in carrying out investment plans (cf. [3] [4]).

Despite this evidence which suggests that the two-Cambridges controversy may simply be a result of a semantic confusion involving savings and investment propensities and the finance motive, let us continue to examine the Neo-Pasinetti Theorem for its implications on the demand and supply of securities in the context of economic growth by utilizing the stock demand and stock-flow supply schedules developed above. Considerations of these in some detail will clarify the Neo-Pasinetti Theorem and free Kaldor from the necessity of restoring the rate of interest to its neoclassical role.

The equilibrium condition expressed in equation (5) tacitly posits that all savings out of wages will be utilized to increase the demand for placements in personal portfolios; and further, that there will be no increase in the demand for speculative money holdings as a store of wealth. Substantially the argument entails that there is a marginal propensity to purchase placements (k) out of personal savings which is assumed to equal unity.[13] If k does equal one, the marginal propensity to hold speculative balances as wealth increases is zero[14] (cf. [1, pp. 195–96] [2]).

1. *When No New Securities Are Issued.* Given the level of investment, and the distribution of income between wages and profits, and the household savings propensities assumed by Kaldor in his Neo-Pasinetti Theorem, then if $k=1$, the demand curve for placements will shift from point A to point B at the initial price of p_1 in Figure 2. This shift from A to B is indicative of an increase in demand which is just sufficient to absorb (at a price of p_1 per unit) a value of additional placements equal to the personal savings out of wages; that is in Figure 2, $ABCE$ must equal s_wW, if $k=1$.

Since k is assumed equal to unity, the area of the rectangle obtained by taking the horizontal difference between the initial D_1D_1' and the

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[13] This is the same assumption Kaldor employed 28 years ago [11, p. 45, no. 1].

[14] Although Kaldor's analysis makes no specific mention of the money supply, it is implicit that the money supply increases by an amount equal to s_wW. Initially therefore workers' savings accrue to them entirely as idle balances. Since Kaldor assumes the marginal propensity to hold speculative balances is zero, the demand for placements curve shifts outwards as described below. It should be noted that Keynes believed that $0 < k < 1$, since "the inactive demand for liquidity partly depends on the aggregate of wealth" [14, p. 668].

new D_2D_2' curve and multiplying it by the ordinate height of the price level, for any price, will always equal total savings out of wages.[15] Thus, the D_2D_2' curve will have a hyperbolic relationship with respect to D_1D_1'; if consumption out of capital gains are precluded (that is, if $c=0$ in equation (5)). If no new securities are issued, then the price of placements would rise until p_5 in Figure 2. This higher price level would induce the public to hold the same quantity of securities in their portfolio as initially even though the state of bullishness had risen (i.e., the demand for placements has increased) because of savings out of wages (or in Kaldor's terminology because of an increase in nonspeculative demand).

Actually, Kaldor has assumed that $c \neq 0$ and consequently, that shareholders may be eager to liquidate some of their securities to finance consumption out of capital gains equal to cG. A value of $c>0$ presumes a sort of "real-placement-balance" effect analogous to the Pigou-Patinkin "real balance" effect. This implies that at any price above the initial p_1 price, the "reservation" demand for securities is contracted somewhat which, in turn means that there is a marginal propensity to demand placements (j), whenever there is a change in the price of placements, which is negative[16] (i.e., $j<0$). If $j<0$, then the portion of the D_2D_2' curve above p_1 does not wholly convey the magnitude of the aggregate demand for placements since the reduction in reservation demand will mean that the quantity demanded at any price will fall short of that shown on the D_2D_2' curve (for the latter is drawn on the hypothesis that $j=0$).

The point is that curve D_2BD_2 depicts the stock demand for placements at any point of time when there is some positive consumption out of capital gains. Hence when $k=1$, and $j<0$, the increase in placement prices will only mount to p_3 as the net increase in bullishness of the public is somewhat repressed compared to when $k=1$ and $j=0$.

If we posit a less than full employment initial equilibrium state, then this additional consumption (out of capital gains) will lead, of course, to an uplift in economic activity and a multiple increase in output (as embodied in the traditional multiplier analysis). A new equilibrium output level will be established where the sum total of personal savings out of wages will be enlarged as employment and the wage bill expands, while capitalists spend in excess of their dividend income (as assumed by Kaldor) and thereby reduce savings out of profits. Money income, real output, and employment will be augmented.

[15] More generally, the area of the appropriate rectangle will always be equal to k times savings out of wages, no matter what the value of k.

[16] At prices below p_1, on the other hand, the oft-mentioned "locked-in" due to a security price fall implies that $j \approx 0$. Kaldor's association of changes in consumption of capitalists with capital gains rather than capital losses tends to suggest he tacitly believes that $j=0$ for prices below the initial price level.

If, on the other hand, we start with the neo-Keynesian assumption of an initial given full employment equilibrium, then the increase in security prices when $j < 0$ induces an increase in aggregate consumption and consequently an increase in aggregate demand. The upshot is the familiar concept of an "inflationary gap" (or an "inflationary barrier" in Mrs. Robinson's terminology [21, p. 13]). This involves an initial disequilibrium between investment and savings (an essential element in the fundamental equations of TM) and with a free market, the Pasinetti model would require the market price to increase to the higher demand price which would yield increased profit margins, a result which is identical to the formation of (windfall) profits in the TM.[17] Under the inflationary gap approach of the post-1936 Keynesian revolution, the adjusting mechanism in a free market requires that money wages and therefore supply prices rise, forcing fixed income groups (particularly bond-holding savers) to cut their real consumption demand because of a reduction in real income. The consequent "forced savings" of rentiers will restore equilibrium in the commodity market by squeezing net capitalist personal savings to a level equal to net investment minus the sum of savings out of wages plus retained profits. (In the Pasinetti model, of course, the forced savings of rentiers will be augmented by the forced savings of workers as the real wage declines with an increase in demand price.)

Thus, the level of output will be the instrument (at less than full employment) for equating net personal and corporate savings with net investment, while the wage-price mechanism and the existence of fixed money income contracts will ensure the equilibrium of net savings and investment at full employment (cf. [5, Chap. 11] [6] [27, Chap. 6]).

On this argument it becomes apparent that even in a Kaldor-Pasinetti world, the price of placements (i.e., rate of interest) will not affect the total of personal savings directly (except for Kaldor's assumed real-placement-balance effect); rather it will have its impact directly on the portfolio balance decision. With $k = 1$, $j = 0$ and no new issues forthcoming then there will be no actual change in the portfolio holdings of the public; as the price of securities rises to p_5 households will be induced to hold the same quantity of securities when their bullishness has increased. Alternatively with $j < 0$, when $k = 1$, then the price of securities need rise only to p_3 to reflect the lesser intensity in bullishness on the part of the public as they continue to hold the same quantity of securities.

Of course, it might be argued that instead of assuming an initial equilibrium level of employment, the comparable case for the Neo-

[17] In fact, Pasinetti's stability analysis involves a differential equation [18, p. 275] which analyzes the same factor (i.e., $I-S$) which leads to dynamic changes in the fundamental equations of the TM [12, Vol. 1, pp. 135–37].

Pasinetti Theorem should begin by positing that corporate savings plus wage earner household savings exceed, at the initial employment level, the exogenously determined level of investment. In this latter case, especially if $c=0$, the demand price for goods will be less than the supply price. This will result in windfall losses (i.e., less than normal profits) in the TM or lower profit margins in the Kaldor-Pasinetti model (or involuntary inventory accumulations in the GT), which should induce profit maximizing entrepreneurs to contract output, thereby lowering the total wage bill until savings and investment are equal. Of course, if, following Kaldor, we assume $c>0$, then the magnitude of the contraction necessary to bring about equilibrium in the goods market would be somewhat less.

Without protracting this analysis further by handling other possible cases, we can state that it does not really matter whether equilibrium in the goods market is initially assumed or not, for it is the level of output and/or the wage-price mechanism and the existence of fixed money contracts which are the primary mechanisms for bringing aggregate supply and demand (i.e., savings and investment) into equilibrium in modern market-oriented economies.

2. *External Finance Via New Public Issues.* The analysis for the situation when corporations issue new securities to the public can be readily obtained by combining, in Figure 4, the combined stock-flow supply analysis of Figure 3 with the demand analysis of Figure 2. For simplicity assume a given level of savings out of wages. If $k=1$, then, as we have already demonstrated, the demand curve shifts from D_1D_1' to D_2D_2' if $j=0$ (or to D_2BD_3 if $j<0$ at prices above p_1) in Figure 4. If the amount of external finance required equals total savings out of wages, that is if $iI=s_wW$, then the increase in the demand for placements at the initial price of p_1 (diagrammatically, a shift from A to B in Figure 4) will be just sufficient to absorb all the newly issued securities. Accordingly, the market supply schedule of securities, S_p+s_{p1}, will be rectangular hyperbola which passes through point B and the increase in the quantity of securities supplied at p_1 will just counterbalance and neutralize the increase in bullishness as households add to the quantity of securities they possess in their portfolios.

If external finance requirements are less than savings out of wages, i.e., if $iI<s_wW$, and if $k=1$, then the rectangular hyperbola market supply curve, S_p+s_{p2}, will locate to the left of point B. Accordingly, if $j<0$, then the equilibrium price will rise to p_2 (or p_4 if $j=0$) as the augmentation in household bullishness is not blocked by a large enough increase in the offering of new issues to maintain the initial price of p_1. The market price rises only enough to entice the more bullish (wage-earning) households to increase the portfolio holdings of securities by
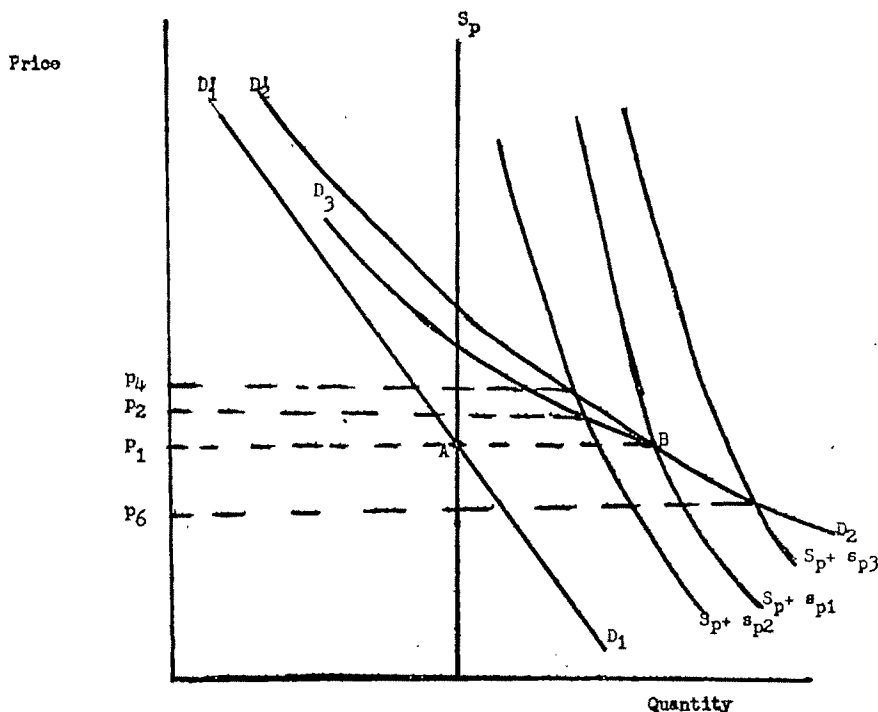
FIGURE 4

an amount equal to the quantity of new issues. Of course, with increased consumption out of capital gains, aggregate demand rises as before and therefore either changes in economic activity (at less than full employment) or alternatively wage-price inflation will carry total net personal savings into harmony with net investment less corporate retained profits.

If the amount of external finance demanded by firms exceeded savings out of wages, i.e., $iI > s_wW$, then the market supply schedule of placements, $S_p + s_{p3}$, would be a rectangular hyperbola lying to the right of point B. This means that firms attempt to float new issues in excess of the increase in bullishness at the initial p_1 price level. Accordingly, if $j = 0$ below p_1 then the placement price level declines to p_6 in order to stimulate households to add to their holdings of securities. In this last situation, one might not expect any change in aggregate consumption since $j = 0$ (by assumption). The lower price of placements, however, signifies a higher rate of interest which in turn could lower the attractiveness of investment by reducing present value estimates, which ultimately could result in a cut-back in output until the savings-investment equilibrium is achieved at a lower employment level with

lower investment and less savings out of wages. If $iI > s_wW$, therefore, full employment may not be able to be maintained as business firms find they can obtain the desired external finance only at higher interest costs. Of course, all this abstracts from monetary policy specifically designed to curtail interest rates to lower levels when employment declines (and an assumed exogenous I).

Summary

The analysis has shown that given the savings propensities of the various income classes and given $k \leq 1$, then the price of placements will alter until the household sector absorbs into its portfolio all the securities offered to it. The change in placement prices (and therefore in the rate of interest) does not in itself affect the total of personal savings or the distribution of savings between workers and capitalists. Given different degrees of bearishness between workers and capitalist households, the price of placements will alter the distribution of securities between them. It is only Kaldor's assumption of a real balance effect for placements when their price increases (that is, a posited negative j) which modifies the savings behavior of capitalists households.

Nevertheless, it is either changes in output (at less than full employment) or inflationary changes in wages and prices at full employment which constitutes the prime channels for working the appropriate changes in the level of personal savings to bring it into equilibrium with the exogenously determined level of investment. The flexibility of the market price of placements merely permits each household unit to hold as many placements as it desires, and to shift its portfolio holdings around as often as desired, while in the aggregate, the personal sector holds exactly the quantity of securities which is allocated to it. The rate of growth, on the other hand, is determined in a modern economy by the investment decisions (of business firms) which can be actually financed and carried out within the monetary and resource constraints of society.

REFERENCES

1. F. P. R. Brechling, "A Note on Bond-Holding and the Liquidity Preference Theory of Interest," *Rev. of Econ. Studies*, 1957, pp. 190–97.
2. P. Davidson, "Money, Portfolio Balance, Capital Accumulation, and Economic Growth," *Econometrica*, Apr., 1968.
3. ———, "Keynes's Finance Motive," *Oxford Econ. Papers*, Mar., 1965, pp. 47–65.
4. ———, "The Importance of the Demand for Finance," *Oxford Econ. Papers*, July, 1967, pp. 245–53.
5. P. Davidson and E. Smolensky, *Aggregate Supply and Demand Analysis* (New York, 1964).
6. ———, "Modigliani on the Interaction of Real and Monetary Phonomena," *Rev. of Econ. and Statis.*, Nov., 1964, pp. 429–31.
7. R. F. Harrod, *The Life of John Maynard Keynes* (London, 1951).
8. ———, "Themes in Dynamic Theory," *Econ. J.*, Sept., 1963, pp. 401–21.
9. N. Kaldor, "Alternative Theories of Distribution," *Rev. of Econ. Studies*, 1954, pp. 83–100.
10. ———, "Marginal Productivity and the Macroeconomic Theories of Distribution," *Rev. of Econ. Studies*, 1966, pp. 309–19.

11. ————, "Speculation and Economic Stability," *Rev. of Econ. Studies*, 1939, reprinted in *Essays on Economic Stability and Growth* (1960). All references are to the reprinted essay.
12. J. M. Keynes, *A Treatise on Money* (London, 1930).
13. ————, "Alternative Theories of the Rate of Interest," *Econ. J.*, June, 1937, pp. 241–52.
14. ————, "The Ex-ante Theory of the Rate of Interest," *Econ. J.*, Dec., 1937, pp. 663–69.
15. ————, *The General Theory of Employment, Interest and Money* (New York, 1936).
16. L. R. Klein, *The Keynesian Revolution*, 2nd ed. (New York, 1966).
17. B. Ohlin, "Some Notes on the Stockholm Theory of Savings and Investment II," *Econ. J.*, June, 1937, pp. 221–40.
18. L. L. Pasinetti, "Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth," *Rev. of Econ. Studies*, 1962, pp. 267–79.
19. D. H. Robertson, *Economic Commentaries* (London, 1956).
20. ————, "Mr. Keynes and 'Finance,' " *Econ. J.*, June, 1938, pp. 314–18.
21. J. Robinson, *Essays in the Theory of Economic Growth* (London, 1963).
22. ————, *Collected Economic Papers*, Vol. I (New York, 1951).
23. P. A. Samuelson, *Economics*, 6th ed. (New York, 1964).
24. ————, "A Brief Survey of Post Keynesian Developments" in *Keynes' General Theory Reports of Three Decades*, ed. by R. Lekachman (New York, 1964).
25. P. A. Samuelson and F. Modigliani, "The Pasinetti Paradox in Neoclassical and More General Models," *Rev. of Econ. Studies*, Oct., 1966, pp. 269–302 and "Reply to Pasinetti and Robinson," pp. 321–30.
26. R. Turvey, *Interest Rates and Asset Prices* (London, 1960).
27. S. Weintraub, *An Approach to the Theory of Income Distribution* (Philadelphia, 1958).

PRICING AND OPTIMUM SIZE IN A NONPROFIT INSTITUTION: THE UNIVERSITY

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I

Those who have ventured into the thicket of the economics of higher education owe an immense debt of gratitude to the distinguished and growing company of economists who have given professional respectability to what less than seven years ago surely ranked among the underdeveloped research areas of our discipline.

The literature on the subject falls roughly into four major segments— at least where it does not defy classification. The largest effort, perhaps, is that which has been devoted to studying the interconnectedness between economic growth and higher education [1] [2] [4] [6] [17] [18]. A second type of research deals with the economic needs and resources of the higher education industry in general [7] [8] [9]. Another body of literature concentrates upon formulating a theory of the economics of higher education [3] [5] [16]. A fourth and growing category of work deals with certain problems of the educational unit itself, and this paper falls into this group of efforts [10] [11].

Two of the more obvious topics of interest to the economist who has lost his head over what we shall call the knowledge-producing firm are pricing and the closely related question of what we mean when we speak of the optimum size of this firm. The bulk of this paper is limited to an informal discussion of but a few aspects of the overall problem delineated by these two topics. The reader is asked to view this paper as an interim report on research in progress. The conclusions and data are derived chiefly from a series of case studies begun in 1963. Because the case material pertains to four-year liberal arts colleges, the term university used in the title should be understood to have this specific and more narrow meaning.

This limitation has a certain advantage if one tries to discover whatever few valid general economic principles there may be hiding on the campus. The four-year liberal arts college is a somewhat more homogeneous educational unit for the analytical and descriptive purposes of the economist than, for instance, a complex modern state or private university.

II

In the jargon of the economist, a college is a sort of firm, and according to Machlup a knowledge-producing enterprise. Siegel says that it

maximizes some utility function subject to a set of constraints [10]. Without trying to take issue with him, I shall develop another concept here, one which could be said to fit into the modern extended version of the theory of the firm.

Even a four-year liberal arts college is not one single firm. In reality it is more like a composite of several often not clearly related, and in some respects fundamentally heterogeneous optimizations. If I may use an already bad term and make it worse, let me call it a multifirm [13].

The most significant difference between this multifirm and the more conventional firm in microeconomics stems from the composition of the income flow and from the optimization principles in force. The traditional theory of the firm evolves around two basic types of optimizations: an efficient cost schedule or production function, and a price which yields some sort of profit or revenue optimum. Whether the firm produces a single good or a complex bundle of products, the key income element is the price or the sum of prices charged.

To be sure the above factors all are present in the educational firm, and optimization rules based on the marginal calculus remain valid and very useful. But there are at least two major differences: in addition to the price we find several other major income sources, and economic optimization rules are sometimes secondary to the overall objective. No doubt, it is this peculiarity which in part inspires Siegel's model, and appropriately so. The following description will illustrate the special problem.

In the conventional college balance sheet we find a number of major separate divisions: current funds; student loan funds; endowment, other unexpendable, and annuity funds; and plant funds. Each fund represents a more or less independently managed balance sheet, in reality an independent input-output set. If one were to consolidate along the more familiar lines of a business balance sheet, the document would perhaps become more readable but also less accurate. Such a reconstruction of the college balance sheet not only obscures but falsifies the legal distinctions and the constraints of tradition which make the college the multifirm it is. In each division the optimization problem is distinct.

A case in point is the endowment division which has received much critical attention of late. The endowment capital is the one economic resource over which a college board of trustees have complete and independent management control. The apparent purpose of an endowment is to provide income for the operating division. An economist might be tempted to design a model for income maximization subject to various constraints, and thus the problem would be quantitative and familiar.

At the risk of some controversy, I should like to suggest that after several years of careful study a quite different model emerges [14]. The

most widely representative endowment model is one where the trustees are trying to maximize some vague trusteeship function subject to all sorts of vague constraints. The outcome is, of course, a certain income flow in favor of the operating account, but one which, in the majority of the cases, never entered systematically or specifically into the calculation.

True, income maximization models do exist. Unfortunately they represent something of a special case, and the current controversy which McGeorge Bundy has raised evolves exactly around this point. We cannot assume that colleges in general are trying to maximize current or future returns on investments subject to known constraints. We can assume this safely for but a few dozen colleges. With college administrators we would wish it to be so generally, but most of them have very little or nothing ot say on how endowments are managed.

III

Another area which supports the multifirm concept is the sum of activities embodied in the operating account. One significant distinction is between the administration of the educational and general services and the management of the auxiliary services component. The latter resembles the conventional business enterprise, seems to have a cost-minimizing dimension, and an income-maximization objective. The following table discloses the interesting fact, however, that almost half of the colleges in a sample of 46 institutions made a net loss in the operation of this division last year.

TABLE 1

NET SURPLUS OR LOSS AS PERCENT OF TOTAL AUXILIARY ENTERPRISE INCOME, 1966–67

Net Surplus %	Number of Colleges	Net Loss %	Number of Colleges
.10– 4.9	7	.10– .9	3
6. – 8.9	5	1. –2.9	8
10. –14.9	5	3. –3.5	1
15. –18.9	6	5. –8.5	6
22.	1	24.	1
31. –32	2	25. –over	1
	26		20

NOTE: There are no colleges in the intervals which have been left out of the table.

Historically there is some stability in this pattern, but the losers and the winners change sides. One must ask what the surplus or loss represents and what purpose the prices must discharge.

Prices charged for college auxiliary services are not intended to yield a profit in the conventional sense of the term, even where a net income

flow appears on the books. The most immediate objective is for the price to cover the typical short-run costs, but not normally any of the capital costs. A punctilious analysis would disclose that some capital items will be included in each instance, particularly for equipment, furnishings, and plant repairs which are not being capitalized. The general untidiness of the accounting practices does not make for sound generalizations in this regard.

In state and private colleges where auxiliary service plant has been built with the proceeds of borrowed funds, total income must in addition be large enough to finance the interest cost and to pay off the debt. Some schools have set their prices for auxiliary services sufficiently high to accomplish this; others have started to show cash losses which may or may not be temporary.

Increasingly one also sees the appearance of small equipment replacement and plant renovation reserves. Comprehensive depreciation policies are not in favor, however; rather than to build up sizable plant depreciation reserves, many colleges find themselves forced to divert each year substantial auxiliary enterprise income into the educational operation proper. Nevertheless, there is a small but slowly growing group of colleges who are attempting to make their auxiliary enterprises more and more self-sufficient with respect to certain long-run or capital costs. In order to be successful they will need a price policy which produces sufficient total revenue. If on top of this the educational account still must be subsidized, a true profit-maximization model will have emerged.

Within the educational enterprise, the auxiliary services component is an economic unit with an economic incentive which in each individual case can be defined quite precisely and which, in general, may consist of either net revenue maximization or net loss minimization subject to specific constraints. For a few models, an $mc = mr$ formula is appropriate, and for some of these the marginal costs include both the short and the long run.

IV

The most interesting pricing problem arises within the educational and general component of a college which would exist even if we eliminated the residential campus. The typical college relies on the following three major income sources: tuition and fees; endowment investments; and gifts from individuals and grants from industry, foundations, religious groups, and government agencies. In addition, as shown earlier, there may be income from the auxiliary services component. The relative weight of each income segment differs sharply from one case to another, but each segment is necessary and its absence would

mean an operating deficit for the institution. The following table gives an idea of the great diversity.

TABLE 2

INCOME BY SOURCE AS PERCENT OF TOTAL EDUCATIONAL AND GENERAL INCOME, 1966–67

Tuition and Fees		Endowment Investments		Gifts and Grants	
%	Number	%	Number	%	Number
31.7–36.8	5	2.2– 4.7	7	3.9– 4.8	4
40. –41.4	3	5.1– 6.5	6	5.3– 7.1	5
45.6–50.4	3	7. – 8.3	7	8.4– 9.2	5
52.3–57.2	3	8.5– 9.5	3	9.5–10.	3
63.6–65.5	3	10. –14.4	7	11.1–13.9	10
65.9–69.8	7	16.2–19.6	3	14.2–15.8	4
70.6–74.5	6	22.4–25.6	3	17. –18.9	3
75.3–79.	5	27.5–29.2	4	20.3–24.7	6
80. –84.5	8	30. –32.6	3	26.8–38.3	4
86. –89.2	3	36. –43.2	3	50.1	1
	46		46		45

NOTE: There are no colleges in the intervals which have been left out of the table. Historically, the weight for tuition and fees has been increasing, while that for endowment income has been declining. The number of colleges budgeting in advance ever larger amounts from gifts and grants has also been rising.

Assuming that the general objective is to provide sufficient income for planned annual expenditures, how is the tuition or price determined? The tuition is a function of the planned enrollment and of the total cost per student not covered by any of the other regular income elements. Competitive constraints play a role, but not in the conventional sense where the slope of the demand would tell us at what point we are pricing ourselves out of the market.

One of the difficulties is precisely that of knowing the demand which may confront a given college at a given time. There is much talk of the large price gap between public and private institutions, and with the advent of the junior college there is also some fear that private college enrollment has ceased to be as open-ended as some believed it to be in the early 1960's. In 1967, several private colleges had to face for the first time in many years a notable decline in their applications, and nationally some colleges were faced with smaller freshman enrollments in the fall than they had budgeted for.

We can make a case for the elastic or competitive demand thesis. Relatively more people can afford and are willing to pay low tuitions; accordingly, lower and not higher tuitions will provide the necessary enrollments. And so with the aid of ever increasing student aid budgets and loan plans we invade this market. One college with an enrollment of 890 students charges about 250 different prices; another with 1,565

and the most discriminatory (if not discriminating) student aid budget we have ever seen lists more than 900 different net tuition prices; and a third institution in a state with a liberal scholarship plan reports that one-third of its enrollment pays between 80 and 75 percent of the tuition, while another third pays as little as 40 percent. The state's new scholarship aid program has doubled that institution's student aid budget.

On the other hand the demand is also inelastic. We find ourselves in a market where there is either real or imaginary product differentiation and therefore monopolistic competition. Those who pay the full tuition for whatever reason subsidize a fairly good chunk of educational activity for those who receive student aid not specifically financed from other sources.

Each college faces several demand curves and operates at various price levels. A representative demand curve is therefore a composite and probably kinked at the point where the enrollment can only be increased by means of major subsidies. And a certain enrollment will pay no price at all. When the tuition is increased the whole scheme may have to move to the right, the enrollment adjustment (if any) concentrating on those who can afford to pay the lowest-subsidy prices. Figure 1 tries to imagine what this might look like.
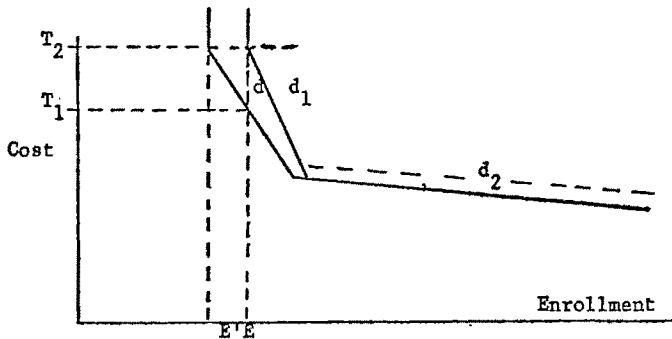
FIGURE 1

EFFECT ON ENROLLMENT OF TUITION INCREASES

An increase of the tuition from T_1 to T_2 produces a potential enrollment deficit of $E'E$. By a successful shift of d to d_1 the deficit can be made up. The shift in demand may result from a recruitment effort. Unless the tuition increase is matched by an increase in the personal income or other relevant circumstances of the clientele, the shift from d to d_1 occurs in part because d_1 may represent a more affluent student body than d. The slope of d_1 may also be different from that of d. It is also possible that d does not change materially, but that the quality of

the enrollment does instead. Finally, d_1 is not likely to shift unless admissions policy changes or the general economic environment has improved per se or by shifting more total resources to higher education at the expense of other sectors.

Sharp tuition increases therefore tend to produce quantitative and qualitative enrollment effects. The more inelastic the demand curve is, the smaller will be the quantitative enrollment effect. The latter will increase the more elastic demand is. Since each demand schedule has a perfectly inelastic segment, tuition increases will have a zero effect on enrollment in that area. Thus it may pay to enlarge the admissions department to find more prospective students who can afford full or low-subsidy tuition payments in spite of planned sharp tuition increments over the four years of their college education.

The nature and scope of the demand for a given college depends on many factors which we do not have the space to discuss here. The crucial factor would seem to be the quality of the educational and non-educational package which the student purchases. The demand elasticity is really an expression of the degree of differentiation for which the student is willing to pay not only the high price of private college education, but the higher prices of the high quality private institution.

Thanks to the efforts of the Ford Foundation, Sidney Tickton, Irwin French, and their associates during the early 1960's, long-range planning has become a reality, and colleges have become accustomed to estimate systematically their future tuition and other educational and general income needs. Long-range planning accentuates the peculiarity mentioned earlier that the tuition charge is determined as a residual item, designed to balance the planning budget. This may remind the economist of cost-plus pricing practices in other monopolistic industries or of administered pricing. To round out the comparison with the familiar, I should like to mention the presence of price leadership elements and of a general looking-over-one's-shoulder type of spontaneous coordination; the latter has been evident increasingly of late and begins with faculty salary policy and culminates with the tuition announcement. Finally, it should be clear to all of us that price discrimination runs rampant.

V

The long-range plans have spawned long-range tuition schemes, some of which are living a precarious existence when one considers the still rather rudimentary art of forecasting college income and expense patterns. Nevertheless, the long-range expense planning efforts are disclosing what may well be the fundamental economic paradox facing the

four-year college which, traditionally, prefers to contain its enrollment growth.

The paradox can be stated as follows: under certain conditions and over the long pull a college may have a cost advantage in rapidly increasing its enrollment; in contrast, its announced desire is to keep the enrollment from rising. In other words, tuition inflation may be reduced markedly by rapid enrollment escalation. Figure 2 depicts a generalization of the problem.
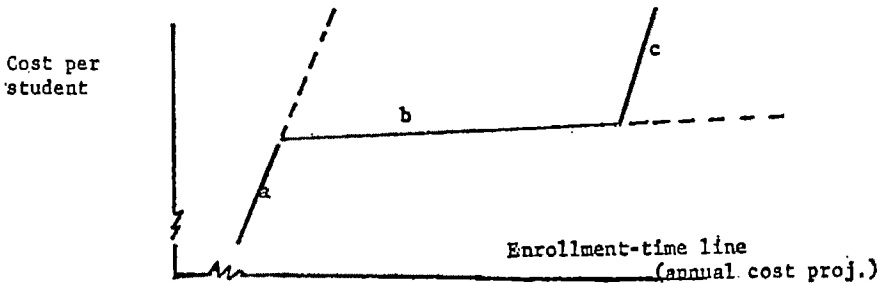
FIGURE 2
COST PER STUDENT PROJECTION UNDER SLOWLY AND
RAPIDLY RISING ENROLLMENT

The kinked line represents a generalized tuition development which has been observed in a series of actual long-range planning cases. Segments a and c show the rate of tuition inflation (semi-log. scale) under near-fixed enrollment conditions. Segment b is the tuition under rapid enrollment escalation. In one actual case, the latter amounted to a 100 per cent increase in four years and allowed a limitation of the tuition inflation to about 3.2 per cent per annum. In another instance a planned enrollment increase of about 10 percent each year reduced tuition inflation by more than 2 percent annually. Of course, the long-range projections of income from other sources are known.

The key to the paradox lies in the relative weight of the individual cost segments. The largest single one is the instructional expense and represents somewhere between 45 and 55 percent of the total educational cost for the majority of institutions in our sample. Because student-faculty ratios are both stable and relatively small, instructional expense can be called the variable cost element.

Our preliminary calculations suggest that the marginal (per student) variable cost is nearly constant for small enrollment increases and that the average variable cost declines under prevailing hiring practices. We further suspect that the average variable cost can be maintained fairly

constant by maintaining student-faculty ratios of between 12:1 and 15:1.[1] Sharply rising average variable costs are the result of the general salary inflation, the new technology in education, and the widespread custom to keep enrollments but not faculty and administrative personnel static.

TABLE 3

EXPENSES AS PERCENT OF EDUCATIONAL AND GENERAL INCOME

Administration and General		Instructional		Library		Operation and Maintenance	
Percent	Number of Colleges	Percent	Number of Colleges	Percent	Number of Colleges	Percent	Number of Colleges
2.6– 4.2	4	31.3–37.	4	2.2–4.1	6	6.5– 7.	2
4.3– 5.5	3	40.6–44.3	4	4.2–4.8	15	7.1– 8.5	1
5.6– 6.2	5	44.4–46.	4	4.9–5.6	8	8.6–10.2	3
6.3– 7.5	13	46.2–47.	7	5.7–6.7	8	10.3–12.7	11
7.6– 8.5	2	47.2–49.6	8	6.8–7.6	1	12.8–14.9	14
8.6–12.3	4	49.7–52.4	6	7.7–9.7	3	15. –16.7	6
12.4–15.8	6	52.5–53.8	3			16.8–19.4	3
15.9–20.7	3	53.9–55.6	3			19.5–21.5	4
20.8–30.	3	55.7–58.4	6			21.6–22.	1
31. –32.	1	61.4–69.1	1				
	44		46		41		45

NOTE: There are no colleges in the intervals which have been left out of the table.

The remaining cost elements are characterized by larger indivisibilities and larger student-to-personnel ratios or lower student-to-personnel costs. Somewhere between 20 and 35 percent of the educational and general costs are fairly independent of enrollment changes, as long as the latter remain moderate from year to year and do not require expansion of the plant. Even if plant is added as a result of substantial enrollment increases, the tuition will only reflect the fixed operating costs; thus again pointing to the desirability of relatively higher enrollments for the sake of relatively less tuition inflation (see Section VI below).

It is the relatively big weight of the more or less fixed costs which reduces the steepness of the increasing per student planning cost functions. Once we know for each institution the proportionality principle which governs the relationship between individual cost components, we shall be able to estimate the potential enrollment-increase cost-advantage for each case.

[1] Given a salary budget for 1,500 students: $1,650,000. Variable per student cost: $1,100. We add one faculty member and we have three salary choices, depending on rank and experience; $8,000, $11,000, and $18,000. How many additional students would it take in each instance to keep the unit cost at $1,100? If we were to exploit fully the economies of scale, it would take at least 7.3, 10, and 16.4 students, respectively. Assuming a student faculty ratio of 1:15, and thus an addition of at least 15 students in each case, the new average cost would be $1,094, $1,096, and $1,101, respectively.

Such an economies-of-scale prospect will not sound particularly novel or exciting to an economist familiar with educational cost structures. Yet the conclusion flies in the face of the conventional wisdom. Why? In part because the four-year college is not interested in enrollment growth, and because it expects tuition escalation to be fought by other means than by exploiting real or apparent cost advantages.

What would happen if all colleges were to increase their enrollments (provided the minimizing of tuition inflation is desirable) in order to take advantage of what is fundamentally a favorable cost condition? This, by the way, is what Beardsley Ruml was talking about several years ago when he was suggesting that the instructional component be restructured for a similar cost flattening effect. We find ourselves faced with the strange possibility where the economic requirements point to the eventual disappearance of the very thing we are studying.
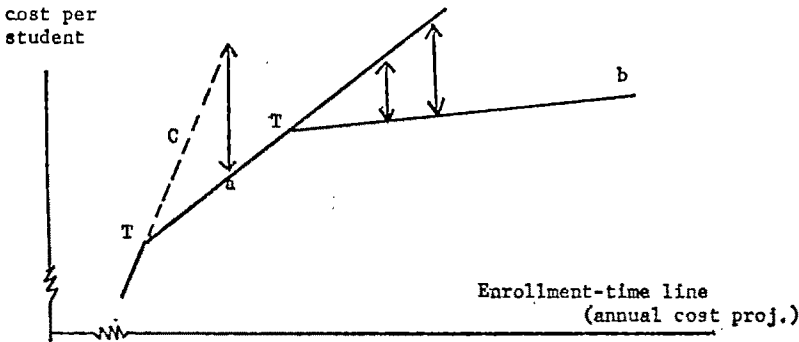
FIGURE 3
THE GAP BETWEEN THE SURVIVAL OF THE "SMALL" COLLEGE
AND THE SURVIVAL OF THE "LEAST-COST" PRODUCER

Lines a, b, and c represent different tuition functions based on stable, moderately rising and sharply increasing enrollments, respectively. Sooner or later each college will reach point T (Figure 3) which I shall call the "temptation point" when its administrators will have to make up their minds whether they wish to take advantage of that specific cost-proportionality which produces a relatively smaller per student cost at more rapidly rising enrollments than under static enrollment conditions.

The institution which succumbs to the temptation may find itself in an accelerating growth condition, particularly as new plant and other capital requirements must be satisfied. The new indivisibilities require further enrollment escalation because they lead to new temptation points.

One of my colleagues, upon seeing some of the long-range planning models, has suggested that I develop an optimal enrollment growth

rate, but I have decided to leave that to later or to some of my friends at the public universities who seem to have been tempted beyond anything which I could discover on the college scene.

The four-year liberal arts college in particular seems to have managed to take a middle-of-the-road approach, opting for relatively small enrollment increases in the hope that society and its own managerial ability would eventually help cope with the problem (see arrows, Figure 3). Thus improved endowment management can be an answer and already is beginning to be. Aggressive and innovative operating gift fund-raising is also in evidence, and this at a time when the economy is able to allocate resources increasingly through this channel. And the growing tendency to subsidize the student from resources which the public sector generates rather than from the institution's own and more conventional income sources will also help reduce the gap.

The few who succumb to the temptation in a significant way do so for excellent reasons and mostly *in extremis*, largely because, for the time being, the non-tuition income sources are not keeping pace with the inexorably rising cost requirements of the institution. And it may be well to remember that the rising costs represent at least in part a different "product" and thus cannot be written off as the result of inflation alone [11].

VI

Economic pressures leading to enrollment growth stand in sharp opposition to the human and qualitative factors defining the educational environment in the four-year liberal arts college. Whether real or imagined, smallness is a major and voluntarily accepted constraint. It is pointless to get into an argument over whether smallness is a relative thing or whether something significantly different happens in a small college as compared to what goes on in a large university. For the moment there is value in smallness however defined and the constraint is real.

The net effect is that economic considerations tend to be relegated to play second fiddle. Instead of an economic optimization subject to constraints, a college tries to optimize in its educational and general component either Siegel's utility function or some more or less easily defined educational benefit subject to various constraints, some of which are economic in nature. Economic efficiency in the internal allocation of scarce resources is of course desirable, and improvements have been made in many instances. But when cost minimization requires enrollment escalation, for instance, we discover that colleges seek a different kind of optimality in their educational endeavor. Normally this optimality cannot be quantified.

However there are instances where we can illustrate how quantitative factors enter the picture. A typical limitation on enrollment is imposed by the requirement that all students either live in college dormitories or eat in college dining facilities, or both. While individuals can eat in shifts, it would seem to be less desirable to sleep in shifts, even though collegiate habits could make possible appropriate scheduling. The physical limitations therefore impose an enrollment limit which may preclude the exploitation of any economies of scale appearing elsewhere in the educational account.

Another limitation to enrollment is present in the student-capacity of existing educational plant. Numerous studies show that such capacity limits often tend to be illusory and that they can be corrected by improved class schedules. Serious institutional and human constraints may prevent significant changes. When full or optimum capacity has been reached, enrollment ceases to be a factor in exploiting possible economies of scale in the educational account at least until new plant is added.

Another constraint is the calendar itself. It has been suggested that it is wasteful to close a college campus for three months each year. And so we have summer school, summer institutes, and the trimester plan. Unfortunately these plans do not really lead to the desired unit cost reduction. The argument is a moral and not really an economic one. Because of weird (to be sure) but generally accepted college accounting practice, the capital cost of the educational plant does not appear anywhere in the calculation of the tuition. Average out-of-pocket costs seem to increase on balance with introduction of new calendars in most cases studied.

This peculiar combination of bad luck must have been the inspiration of the semester-away-from-the-campus alternative. The special gimmick—and one which works—is to make sure that several hundred students stay away from the campus altogether for at least one term during their four-year college stint. While away they pay various fees and even tuitions. They may be studying abroad or independently. The key is that the students do not clutter up the premises and that they do not tie up the faculty.

Finally, our surveys disclose colleges which have long-range plans in which a maximum desired enrollment has been imposed at the outset on the design of both the plant and the curriculum structure. It is too early to say whether such integrated plans are in fact as rationally sound as their proponents suggest. Pending further evidence we might give them the benefit of skeptical doubt.

For a clear understanding of the economics of the educational firm it would seem to be the better part of wisdom to assume that within the

confines of the educational and general division the key optimization is noneconomic and that this optimization is subject to constraints, some of which are economic.

VII

If we are to believe what we read in the press, there is a new financial crisis upon us in higher education [15]. When the alarm is sounded the stress is mostly on the alleged scarcity of economic resources for educational firms. Much is made of the probability that a private college here and there will either disappear or be forced to become a public institution. At worst, such happenings would demonstrate that there is something of a competitive environment in which the fit survive and adapt while the unwanted disappear.

Before pronouncing final judgment, one might wish to know something more about the rules of the game which the colleges are forced to play. Admittedly, some of these rules may put the private college at a severe competitive disadvantage, particularly when they are not of its own making. On the other hand, much of the decision making is autonomous such that the cries of anguish address themselves often to the wrong audience.

Some of the things which have been said suggest that the problem facing the colleges is both the lack of necessary resources and what happens to them once the educational establishment gets its hands on them. For if one were asked in one of those contests to describe not only the most expensive form of higher education, some of the clumsiest methods of long-range financing, the least productive decision processes for the managing of earnings assets, and a complex set of heterogeneous suboptimizations, he would most assuredly win a prize by coming forth with a model of the private four-year college as we have come to know and love it in this country.

REFERENCES

1. Charles A. Anderson, ed., *Education and Economic Development* (Aldine Pub. Co., 1965).
2. Gary S. Becker, *Human Capital: A Theoretical and Emperical Analysis*, N.B.E.R. (Columbia Univ. Press, 1964).
3. Samuel Bowles, "The Efficient Allocation of Resources in Education," *Q.J.E.*, May, 1967.
4. H. Correa, *The Economics of Human Resources* (Amsterdam: North-Holland Pub. Co., 1963).
5. André Daniére, *Higher Education in the American Economy* (Random House, 1964).
6. Edward F. Denison, *The Sources of Economic Growth and the Alternatives Before Us* (C.E.D., 1962).
7. Seymour E. Harris, *Higher Education: Resources and Finance* (McGraw-Hill, 1962).
8. Fritz Machlup, *The Production and Distribution of Knowledge* (Princeton Univ. Press, 1962).
9. Selma J. Mushkin, ed., *Economics of Higher Education* (U.S. Dept. of Health, Education, and Welfare, 1962).
10. Barry N. Siegel, *Towards a Theory of the Educational Firm* (Center for the Advanced Study of Educational Administration, Univ. of Oregon, 1966).
11. John W. Bartram, "Why Higher Unit Costs in Higher Education?" (Univ. of Colorado, mimeo., Oct., 1962).

12. Robert Campbell and Barry N. Siegel, "The Demand for Higher Education in the United States, 1919-1964," *A.E.R.*, June, 1967, pp. 482-94.
13. Hans H. Jenny, "Some Reflections on the Concept of Capital Formation." The Principles of Optimization and Endowment Management Performance in Higher Education, Annual Meeting, Ohio Association of Economists, Columbus, 1965 (mimeo.).
14. ———, "Simulation and Optimization in Portfolio Selection." The Fourth International Conference on Operational Research, *Pre-Prints of the Proceedings*, Boston, 1966.
15. Duncan Norton-Taylor, "Private Colleges: A Question of Survival," *Fortune* (reprint, Oct., 1967).
16. E. F. Renshaw, "Estimating the Returns to Education," *Rev. of Econ. and Statis.*, Aug., 1960, pp. 318-24.
17. T. W. Schultz, "Reflections on Investment in Man," *J.P.E.*, Oct., 1962, pp. 1-8.
18. H. G. Schaffer, "Investment in Human Capital: Comment," *A.E.R.*, Dec., 1961, pp. 1026-1039.

DISCUSSION

HAROLD H. WEIN: Professor Jenny is concerned with two important problems of a four-year liberal arts college: its pricing policy and its optimal size. He characterizes his paper as an "informal discussion" and "an interim report of research in progress." As for the research in progress, it consists of data on forty-six colleges. The two tables presented by Professor Jenny give some information on current income by source of income; that is, the percentage derived from tuition and fees, endowment investments, and gifts and grants. It comes as no surprise to academicians that tuition and fees fall substantially short of meeting operating expense. Apparently for the forty-six colleges in Professor Jenny's sample, income from sources other than tuition and fees averages close to 40 percent of total income. The other information shows that even income derived from auxiliary services provided by these colleges do not for many of them cover their operating expense.

As Professor Jenny gives no information on the research design (or other information which may have been found), it is difficult to comment on its adequacy to answer his two problems—either posed as empirical questions or normative ones. Nevertheless, some tentative answers are provided. As for pricing, liberal arts colleges practice price discrimination. They soak rich students and give scholarships and other subsidies to poor students. Apparently none of his forty-six colleges appear to have found a completely effective system of price discrimination—or perhaps they do not want to, since for none of them do tuition and fees completely cover current operating expense, let alone contribute to the capital account.

As for optimal size, Professor Jenny observes that the colleges he studied appear to have economies of scale or short-run decreasing average costs per student. This comes from substantial fixed costs (noninstructional costs) in administration and physical plant—grounds, buildings, and so forth. Marginal costs are thus below average costs, and according to Professor Jenny appear to be relatively constant with fixed student-faculty ratios other than for price inflation. Given this situation, the college which is in fact pricing either at short-run marginal cost and certainly below long-run marginal cost will of course show losses. They must be subsidized, which they are through gifts and grants. But they are under pressure to cut their losses, and so they are tempted to increase output; i.e., increase enrollment. Thus Professor Jenny's "paradox" is of course quite orthodox, and the bounty Marshall proposed for industries subject to economies of scale is in fact being paid, even though it requires considerable effort on the part of college administrators to obtain the requisite gifts and grants and endowments.

The dilemma for the small liberal arts college is that this sort of economic analysis tells them to grow larger—but they do not wish to grow larger. Professor Jenny draws a conclusion, perhaps facetious, which is that the four-year liberal arts college is the "most expensive form of higher educa-

tion, has some of the clumsiest methods of long-range financing, the least productive methods of managing earnings assets, and a complex set of heterogeneous suboptimizations." This is a gloomy conclusion. It would seem to forecast the demise of the small liberal arts college. And indeed if it were a firm or a multifirm in the jargon which Professor Jenny adopts, one should wonder why it has lasted as long as it has. The pall of gloom is shattered, for as Professor Jenny says in this country "we love it." And as we all know "love is blind"—and so it will continue to survive, protected by the blindness of love.

Obviously, higher education is very costly, and a rational society should attempt to achieve whatever it believes it wants to achieve from higher education at a lower cost rather than a higher cost. There are three separate problems. The first relates to the total amount of expenditures or resources which should be at the disposal of higher education. The second relates to the funding of this cost: how much from students directly, how much from government, and how much from private (nonstudent) sources. The third relates to the institutional mix: what is the best role for a small liberal arts college, for example.

The first difficulty is that there appears to be no agreement on what as a society—a democratic and developing egalitarian society—we wish to obtain from varying sums spent on higher education. Clearly not all colleges and universities are "knowledge producing firms." New knowledge in all fields comes from many diverse sources outside the ivory towers. Four-year liberal arts colleges in particular produce relatively little new knowledge. They produce educated young men and women. How much is this worth—to the students themselves, to their employers, to society? Even though we may be sentimental about the value which a small liberal arts college is alleged to provide, its role in a rapidly changing and troubled society is worth serious and unsentimental study.

This requires some sort of cost-benefit analysis—perhaps first pioneered by the insurance companies who continually advertise the differential worth of a college education over a lifetime. It is clear that most four-year degrees are sought by students for a variety of reasons—a most important one being its job value. Whether the discounted returns over a working lifetime of a four-year degree or a master's or Ph.D. exceeds its discounted cost I do not know. It is certainly one aspect of the analysis—but there are others not so easily measurable. We claim as college professors, though I have not seen the proof, that the college educated make better citizens. What I am suggesting is that the differential job worth discounted cash analysis is not the whole picture—since education is an end in itself sort of thing which the market value of a degree does not fully reflect. The benefits of education are clearly larger than the market value both to society and to the individuals who receive the higher education. Just what these benefits are and could be if educational curricula and institutions were imaginitively reconstructed is worth serious study.

The problem of "pricing" higher education reflects the bias of conventional microeconomics. It seems particularly inappropriate in a society

which, Governor Reagan to the contrary, is inevitably approaching the view that higher education should be virtually free to those students who have the ability to profit by it, or at least the view that students who cannot pay for it ought not for that reason to be deprived of it. We will certainly not be unique when we finally do achieve "free" higher education, which already exists in many socialist and nonsocialist societies. But the present mixture of tuition discrimination and grants and gifts from business, foundations, individuals, and government which grew up in response to the rapidly increasing enrollment and the tax laws is untidy to say the least. They are not likely to be adequate in the face of continuing pressure to accommodate a rapidly growing number of students from poor families.

Our present funding mechanisms have one common feature. The grant is made in most cases directly to the college or university who administers it and selects its student body. Another alternative much less used is to make the grant directly to qualified students and permit them to choose the particular college they desire. This would introduce a market mechanism and exert pressure on colleges and universities to respond more quickly to student preference. As it works now, the grants flow on the basis of persuasiveness of university officials, images which grantors have of particular institutions, and other, perhaps political, considerations. I don't know which mechanism would be better. But in any case the problem of funding an expanding higher education is a rich field of inquiry.

The third problem goes to the organization of higher education, and its relationships with those other nonacademic institutions which create new knowledge which train and which inculcate social and personal values. Government agencies such as NASA, AEC, and so forth obviously create much new knowledge. So does business and many other organizations. How do these organizations and colleges and universities interact and how best to divide the common functions are problems worth serious investigation?

Each of the three problem areas mentioned seems to me the one which requires study. Any attempt to force them into a procrustean bed of microanalysis on a colorful though inappropriate analogy with economic firms is to render the analysis irrelevant to the serious problems which higher education faces.   .

ALLAN COTTA: The contribution of Professor Davidson has as its main purpose to introduce, more clearly and more closely than they usually are, the monetary factors into the analysis of real growth. As such it is of great interest, for it becomes more and more obvious that one of the main lags which exist between models of growth and policies of growth are due to the frequent disregards of monetary factors by model-makers.

This introduction is made with two special references. First to both major works of Keynes: the *Treatise on Money* and the *General Theory*; second to the recent controversy between the two Cambridge schools called "a tempest in a teapot." It seems quite clear that Professor Davidson wanted to be, in some ways, helpful to both Pasinetti and, chiefly, Kaldor,

by preventing them from being heterox, namely, from recognizing that the rate of interest (or the price of securities), and not only the level of national product and/or the rate of inflation and/or the price wage mechanism, has some role in adjusting saving and investment. To do that, it is also obvious that Professor Davidson tries to rehabilitate the *Treatise on Money* with respect to the *General Theory*.

We are, of course, in a very important debate. It would be somewhat useless to enter into it. Instead we shall examine how Professor Davidson himself goes through it. His analysis of the role played by the market of securities, largely inspired, as he wrote it, by the *Treatise on Money* deserves the following remarks.

The first is the lack of a precise definition of what he means by "securities." When he defines the public's demand for securities (or placements), he adds "or placements" which seems to make you authorized to define securities as financial assets, whatever might be their holders, debtors, maturities, and markets. But in some other parts of his paper and mainly in his central analysis, he seems to assume that securities should have "a market," which restricts the definition of securities to those which can be easily and immediately sold and bought at given moments of time.

Even if we take the restricted definition of securities as all financial assets which have a market and speak, for example, of stocks and bonds markets, the whole analysis developed by Professor Davidson deals essentially with the equilibrium (and changes in this equilibrium) between demand for external financing by entrepreneurs (igK/p) and public demand for securities $D_p=f_1(\rho, \lambda, \beta, \nu, e, V)$. The whole analysis lies upon a given assumption made, not only about the price elasticity of this demand, but mainly about the relative importance of this price elasticity compared to other elasticities, $f_{1\lambda},' f_{1\beta},' \cdots f_1'V$. Of course, if all other variables, except ρ and later V, are given and fixed, we can admit the conclusions of Professor Davidson. But is this the case? More exactly can we, speaking of changes in the prices of securities, assume that, for example, λ (the set of expectations) is given. In other words, which of the two elasticities $f_{1\lambda}'$ and $f_1'\rho$ has the more importance?

The answer made by Keynes in the *General Theory* is quite clear and we, all,. know his judgment about this "activity of casino's game" which, I think, explains why net savings by households or, more specifically, variations in their placements do not depend on variations in prices of securities but on expected variations in their prices. So the central assumption made in this paper, namely, that "the public will want to substitute placements for money holdings as the price of securities declines," ought to be better justified—if it is to be justified at all. And so it is for the two central parameters k and j (or c) the variations in which cannot be, primarily, explained by variations in prices of securities.

It is the weakness of this relationship which explains the altogether speculative rather than rational behavior of many securities markets, the lack of reliance on them in many countries and the lack of reliance Keynes showed them in the *General Theory*.

Even if we don't still take the term securities in a broader sense, it seems difficult to go on assuming that the equilibrium (and changes in it) between net savings from households and external financing by firms is the result of a direct confrontation on one or many specific markets. In other words, it is difficult not to introduce the existence of financial firms or institutions. We know that, precisely because of the "speculative" behavior of financial markets, households prefer, in fact, to lend to financial institutions and that firms prefer to borrow from them. The introductions of financial institutions oblige us to consider not only two functions (supply and demand of securities) and one price (p) or one rate of interest but four functions and two prices p_1, p_2 (or two rates of interest i_1 and i_2). The first is the rate at which households lend (i_1) and the second the rate at which firms borrow (i_2). The difference between the two ($i_2 - i_1$) becomes the profit—or rate of profit—of financial institutions.

Obviously, the equilibrium studied by Professor Davidson could be used if and only if we assume that financial institutions are dependent on both their lenders and their borrowers or, if we prefer, that their profit (pure) is equal to 0, $i_2 - i_1$ just covering their operating expenses. But we know that is far from the truth: profit of financial institutions is not 0, and their two policies (lending and borrowing policies) exert on the equilibrium (both quantity and price of securities) a very great influence we would have wanted to be introduced in the present analysis.

If, now, we assume that the term securities means the whole set of financial assets, defined according to their debtors and their creditors, the relationship between the real and the financial world of the growth could not any more be restricted to one equilibrium between only two agents of the economic activity: households and nonfinancial firms. Actually, even if we consider a closed economy case, as both Professor Davidson and other people involved with the controversy did, we are obliged to consider four agents; namely, households, enterprises, state and financial institutions. The only way to integrate financial and real aspects of growth is to consider a financial matrix such that its entries X_{ij} is the total amount of money due by i to j and dX_{ij} its variation over time. The present paper deals only with one peculiar dX_{ij} when i is enterprises and j is the households.

The recent known facts about growth of, at least, the developed Western countries will oblige us to emphasize the role played by the publicly-owned financial institutions (which are not nonprofit institutions) in the simultaneous evolution of real and financial flows and assets; the role played by the private financial institution—the rates of profit of which should alter both investment—the rate of growth—and rates of interest; the role played by the overall internal financing (dX_{ii}) of our four agents in the increment of the total amount of financial assets. If every agent is given the choice between hoarding, placement, buyings of real goods (consumption or investment), the ways in which would, both, grow real and financial assets seem much more intricate and difficult to describe than in one simple equation as that taken by Kaldor or neoclassical economists; and

the role played by the price of securities would, I personally think, be more close to that described in the *General Theory* than in the *Treatise on Money*.

I should add that I understood and appreciated very much attempts made by Professor Davidson to introduce the more accurate and detailed analysis of the *Treatise on Money* in the "growth field." But I go on thinking that it is not at all a paradox that the GT has had much more spread and success than the TM. We have in the GT, at a very low conceptual cost, all our agents on the stage plus assumptions made on their relative power: financial institutions including the central bank determining more than everybody else the rate of interest, partly determining the investment (of the nonfinancial firms), determining what everybody else (you and I) must save—if we must consume or accumulate (durable goods).

At least, I would believe, like Kaldor that we need many more tempests in a teapot and chiefly, many more tempests in much bigger teapots.

ALEXANDER NOWICKI: The paper delivered by Messrs. Soper and Webb represents a notable step forward in the use of two-factor, two-commodity models.

Historically, this group of models reflects a permanent search for stable equilibrium. The history of economic thought in the last hundred years or so is littered with corpses of equilibrium models. There is fortunately a logic in their disappearance from the major scene, and the learning curve of their authors was steep enough. Because they still belonged to generations which were learning from the errors of their predecessors, models were gradually becoming more realistic and more policy-oriented and therefore more useful, on the whole.

The whole trouble started, probably, with Walras. We are reminded of two of his basic statements; namely, that "if the system is at its equilibrium position, then any arbitrary departure from this position generates dynamic market forces which bring it back" and "no matter what the initial position from which the system starts, the dynamic working of the market forces bring it to its equilibrium position." Walras, while defining a position of equilibrium did not supply in his exchange equations any information as to the path by which that position could be reached.

Von Neumann's concept of equilibrium growth probably comes next. It establishes conditions for the existence of a path towards equilibrium and some of its characteristics. Then entered Sir Roy Harrod with classical Keynesian doubts, pointing out that an economy, once off the path of golden age equilibrium growth, cannot automatically return to that path in conditions mainly of laissez faire, but only through combating unemployment or inflation. Another bridge on the difficult road towards equilibrium was then laid by Dorfman, Samuelson, and Solow, in a shape of a turnpike theorem. While simpler relative stability models, established previously, considered time paths extending indefinitely into the future, the asymptotic property of the turnpike theorem was concerned with time paths extending for finite time. But, as Sir John Hicks noted, we still do

not know how rapid is the convergence of the actual optimum to the turn-pike. The actual optimum path, being restricted by an initial capital stock, and the far future remaining largely uncertain, the turnpike is left still beyond the immediate grasp of the policy-makers.

And, finally, the most recent group of models has been initiated by Shinkai and continued by Uzawa, Inada, Takayama, and Kurz. While the previous builders had enriched the initial equilibrium models by embellish-ments concerning policy measures and the time elements, this last group, following the independent initiatives by Solow and Salter, tried to intro-duce some elements of technology. This was limited, in its first phase, to a condition that the consumption goods industry is always more capital intensive than the investment goods industry. But, according to Solow, it seems paradoxical that an important property such as stability should depend on such a casual property of technology as this.

Moreover, the stability condition in this group of models depends upon two basic relations; namely, the elasticity of factor substitution of both production functions, and the determining influence of the wage-rental ratio.

The role of both these relations can be easily explained. Whenever the elasticity of factor substitution is sufficiently high, the balanced growth path could be regained through the interplay of two movements. As was noted by Drandakis, a relative abundance of one of the factors could be accommodated by an interindustry movement towards the industry which uses relatively more of that factor. This also concurs with the Rybczynski theorem. Moreover, whenever alternative techniques of production of one or both of the goods exist, an intra-industry movement is of additional help. With changes in the equilibrium prices, a change in the factor proportions in the relevant industry will occur and, if factor substitutability is high enough, the absorption of the relatively abundant factor is ensured with only small interindustry movements.

The change in relative prices brings us back, however, to the wage-rental ratio. Its determining role for equilibrium models was stressed strongly by both Sir John Hicks and Robert Solow. Hicks proves that, in a two-sector growth equilibrium model, if wages and the cost of machines are fixed in terms of consumption goods, the relative price system is determined before we say anything about saving or about the growth rate of the economy, given that earnings of the factors must be the same in both industries in conditions of equilibrium. Solow, in interpreting the Uzawa model, brings in an auctioneer who determines a value for the wage/rental ratio. Since each separate industry has a corresponding optimal machine/labor ratio and since all the machines and all the labor must find employment, the given value of a wage/rental ratio determines the division of the labor force between the two sectors and thus also the division of machinery and the two outputs. Both industries make optimal adjustments which yield unit costs; the competition takes care of the rest, setting the relative price ratio for the two commodities equal to the ratio of unit costs. This is a first equilibrium condition where wage/rental ratio determines relative prices.

The second equilibrium condition requires that $wL/rK = P_2Y_2/P_1Y_1$, where Y_2 and Y_1 are the outputs defined from the first condition. The conditions together set a unique relation between the wage/rental ratio and relative commodity prices.

We approach here the content of Messrs. Soper and Webb's paper. Following Harrod, the authors felt that the return to equilibrium calls for policy measures. The exposition starts with references to the Phillips curve and, although the four panels of Figure 3 deal, independently, with restraints on both factors, we can reasonably guess that it is the labor-factor utilization which is of main interest to the authors. Moreover, their further reference to Gordon's statistical work, showing that prices of capital goods have risen faster than prices of consumption goods, seems to reflect, in an indirect way, the authors' idea that one of the answers to the return-to-equilibrium problem lies in the change of relative prices.

This is a formidable question and it has not and could not have been exhausted in the paper. It is, nonetheless, the only question which deserves to be answered.

The results of a policy decision of this kind, while they may be absorbed more or less easily by the model, will almost certainly influence other economic variables outside the model. Thus, even in comparative statics, the assumptions will have to change. We cannot escape from this cybernetical inevitability, as our world is fatally cybernetical. After having introduced time, as well as some elements of technological choice and some elements of policy decision into the equilibrium models, one wonders what will come next?

By introducing more of a time element we can obtain a terminal path growth and a series of gradual adjustments. This appears useful if we consider that deviations from equilibrium are always acceptable but should remain bounded. By introducing more technology we may find, following Salter, that changing factor prices are liable to influence best-practice techniques. We may also find that the marginal productivities of capital do not rise in the same proportion, since the elasticities of marginal productivities with respect to capital are not the same in the two sectors. And, as Baumol has proven not a long time ago, an attempt to achieve balanced growth in a world of unbalanced productivity must lead to a declining rate of growth relative to the rate of growth of the labor force. We will also find how relative factor prices decide the degree of outmodedness by changing standards of obsolescence. But the latter, in their turn, will influence the productivity of at least one factor: capital.

Decisional or instrumental variables must next be considered. One wonders where the neutrality of money in models ends. We can assume that money is neutral in a static model, but does it remain neutral in comparative statics also—especially in models like that of Soper and Webb, where changes of relative prices are apt to alter the saving rate with all the implications that could bring about?

Finally, could our equilibrium model continue to be of a closed-economy type in the contemporary world?

I used my privilege of a discussant in avoiding to question the consistency of the model. It is an excellent paper and it is difficult to say much about an excellent paper, after one has called attention to its quality. I have tried simply to trace the difficult path which led to its appearance and the even more difficult path which leads on from now.

NONMARKET DECISION MAKING

THE PECULIAR ECONOMICS OF BUREAUCRACY

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I. *Introduction*

Economics does not now provide a theory of the maximizing bureaucrat. The currently dominant approach to public administration is to provide the organizational structure, information system, and analysis to bureaucrats who, for whatever reason, want to be efficient. This approach, however, does not develop, or explicitly recognize as relevant, the conditions for which the personal objectives of the bureaucrat are consistent with the efficiency of the bureaucracy.

At present, with a large and increasing proportion of economic activity being conducted in bureaus, economists have made no substantial contribution to answering the following questions: What are the distinguishing characteristics of bureaucracies? What are the critical elements of a theory of bureaucracy? Specifically, what do bureaucrats maximize and under what external conditions? What are the consequences of maximizing behavior under these conditions? For example, what is the equilibrium output and budget of a bureau for given demand and cost conditions? What are the effects of changes in demand and cost conditions? What are the welfare consequences of bureaucratic organization of economic activity? What changes in organization and the structure of rewards would improve the efficiency of a bureaucracy? This paper presents a simple model of the maximizing bureaucrat and, based on this model, a set of tentative qualitative answers to these questions.

II. *The Model*

The model outlined in this section is based on the following two critical characteristics of bureaus: (1) Bureaucrats maximize the total budget of their bureau, given demand and cost conditions, subject to the constraint that the budget must be equal to or greater than the minimum total costs at the equilibrium output. (2) Bureaus exchange a specific output (or combination of outputs) for a specific budget. For this paper, thus, bureaus are defined by these two characteristics.

Among the several variables that may enter the bureaucrat's utility function are the following: salary, perquisites of the office, public reputation, power, patronage, ease of managing the bureau, and ease of mak-

ing changes. All of these variables, I contend, are a positive monotonic function of the total budget of the bureau.[1] Budget maximization should be an adequate proxy even for those bureaucrats with a relatively low pecuniary motivation and a relatively high motivation for making changes in the public interest. It is an interesting observation that the most distinguished public servants of recent years have substantially increased the budgets of the bureaus for which they are responsible.

The second characteristic—bureaus exchange their output for a total budget rather than at a per unit rate—is generally recognized, but the implications of this characteristic for the behavior of a bureau are not. This characteristic gives the bureau the same type of "market" power as a monopoly that presents the market with an all-or-nothing choice.[2] A bureau, thus, can appropriate all of the consumer surplus. As is shown later, however, this characteristic leads to significantly different output, budget, and welfare conditions for a bureau than for a monopoly.[3]

The equilibrium conditions for a bureau, as defined by these two characteristics, are developed below by considering a bureau faced by linear demand and cost conditions. First, consider a bureau that buys factors in a competitive market and for which

$$V = a - bQ$$

and

$$C = c + 2dQ,[4]$$

where

$V \equiv$ marginal value to consumers
$C \equiv$ minimum marginal cost to bureau

and

$Q \equiv$ output of bureau.

For these conditions, then,

$$B = aQ - \frac{b}{2} Q^2$$

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[1] This paper develops only the static model of a bureau and does not explore the time dimension of budget maximization.

[2] I am indebted to Gordon Tullock for this powerful insight.

[3] This characteristic applies strictly to a "pure" bureau, such as the Department of Defense. Many economic institutions such as the Post Office, most colleges and universities, and most hospitals sell part of their output at a per unit rate and a substantial proportion of their output for a budget.

[4] The marginal cost function for a bureau that is not a discriminating monopsonist includes the factor surplus. The average cost function to this bureau and the corresponding marginal cost functions for a monopoly or bureau which is a discriminating monopsonist would be $C = c + dQ$.

and

$$TC = cQ + dQ^2,$$

where

$B \equiv$ total budget of bureau

and

$TC \equiv$ minimum total cost to bureau.

The equilibrium level of Q, for these conditions, is determined as follows: Maximization of B leads to an upper level of $Q = a/b$. The constraint that B must be equal to or greater than TC, under some conditions, leads to a lower level of $Q = 2(a-c)/b+2d$. These two levels of Q are equal where $a = 2bc/b - 2d$. For a bureau that buys factors in a competitive market, the equilibrium level of Q, thus, is where

$$Q \begin{cases} = \dfrac{2(a - c)}{b + 2d} & \text{for } a < \dfrac{2bc}{b - 2d}. \\[3mm] = \dfrac{a}{b} & \text{for } a \geq \dfrac{2bc}{b - 2d}. \end{cases}$$

Figure 1 illustrates these equilibrium levels of output for representative demand and cost conditions.

For the lower demand condition represented by V_1, the equilibrium output of a bureau will be in the budget-constrained region where the area of the polygon ea_1hi is equal to the area of the rectangle $efgi$. At the equilibrium level of output, there is no "fat" in this bureau; the total budget just covers the minimum total costs, and no cost-effectiveness analysis will reveal any wasted resources. The output of this bureau, however, is higher than the Pareto-optimal level. The equilibrium level of output is in a region where the minimum achievable marginal costs ig are substantially higher than the marginal value to consumers ih, offsetting all of the consumer surplus that would be generated by efficient operation at lower budget levels. If minimum marginal costs increase with output as a consequence of increasing per-unit factor costs (rather than diminishing productivity), this bureau will generate a substantial factor surplus equal to the triangle cfg—larger than would be generated at the lower, Pareto-optimal output. Legislatures predominantly representing factor interests understandably prefer the provision of public services through bureaus.

For the higher demand conditions represented by V_2, the equilibrium output of a bureau will be in the demand-constrained region where the marginal value of output is zero. In this case the total budget will be
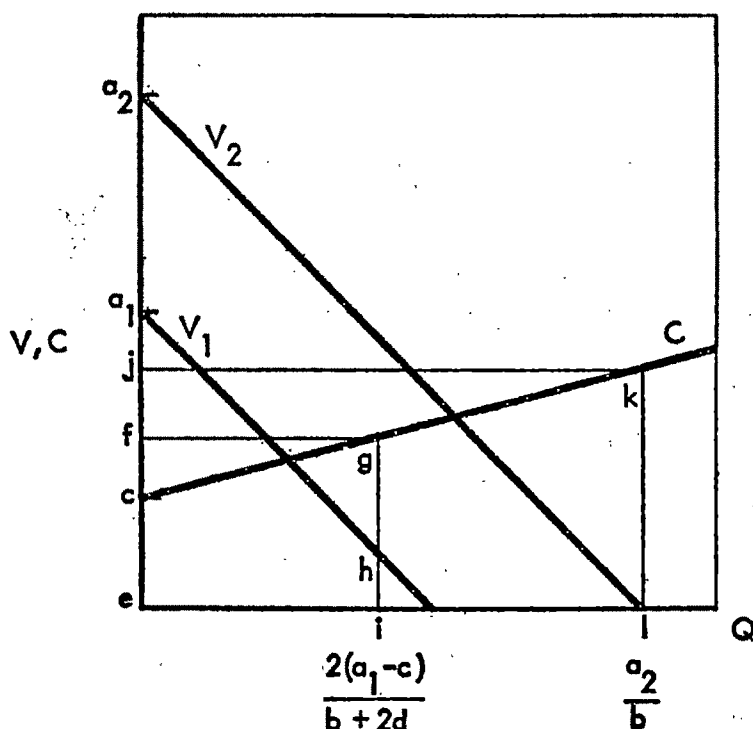
Figure 1
Equilibrium Output of Bureau

equal to the triangle ea_2l and will be larger than the minimum total costs equal to the rectangle $ejkl$. At the equilibrium level of output, there is "fat" in this bureau. A careful analysis would indicate that the same output could be achieved at a lower budget, but the analyst should expect no cooperation from the bureau since it has no incentive to either know or reveal its minimum cost function. In this region, the equilibrium level of output is dependent only on demand conditions. The output of this bureau is also higher than the Pareto-optimal level, operating at an output level where the minimum marginal costs are equal to lk and the marginal value to consumers is zero, again offsetting all of the consumer surplus. The factor surplus generated by this bureau, of course, is also substantially larger than would be generated by a lower, Pareto-optimal output level.

III. *Comparison of Organizational Forms*

A better understanding of the consequences of bureaucratic organization of economic activity can be gained by comparison with the consequences of other forms of economic organization facing the same

demand and cost conditions. Table 1 presents the equilibrium levels of
output and related variables for a private monopoly which buys factors
on a competitive market, a private monopoly which discriminates
among factor suppliers, a competitive industry, a bureau which buys
factors on a competitive market, and a bureau that discriminates among
factor suppliers. Each form of organization faces the same following
demand and cost conditions:

$$V = 200 - 1.00\ Q$$
$$C = 75 + .25\ Q.[5]$$

TABLE 1

EQUILIBRIUM CONDITIONS FOR ALTERNATIVE FORMS OF ECONOMIC
ORGANIZATION FACING SAME DEMAND AND COST CONDITIONS

Product Market	Monopoly		Competitive	Bureau	
Factor Market	Competitive	Monopsony	Competitive	Competitive	Monopsony
Measures					
Output............	50	55.6	100	166.7	200
Revenue:					
Total...........	7,500	8,024.7	10,000	19,444.4	20,000
Average........	150	144.4	100	116.7	100.0
Marginal.......	100	88.9	100	33.3	0
Costs:					
Total...........	4,375	4,552.5	10,000	19,444.4	20,000
Average........	87.5	81.9	100	116.7	100.0
Marginal.......	100.0	88.9	100	158.3	125.0
Profits............	3,125	3,472.2	0	0	0
Consumer surplus..	1,250	1,543.3	5,000	0	0
Factor surplus.....	312.5	0	1,250	3,472.2	0

The traditional concern about private monopolies is that they pro-
duce too little output. Operating in an output region where marginal
value is greater than marginal cost, they do not generate as much
surplus value as would a competitive industry. For the demand and
cost conditions shown in Table 1, a private monopoly would generate
a sum of profit plus consumer and factor surplus around 75 percent that
of a competitive industry.

For these demand and cost conditions, a bureau that buys factors on
a competitive market will have an equilibrium output around two-thirds
more than the competitive industry. This bureau will generate no profits
or consumer surplus but will generate a factor surplus around 55 percent
of the total surplus from a competitive industry. For these conditions,

[5] This is the average cost function to a monopoly or bureau that is not a discriminating
monopolist, the marginal cost function to a discriminating monopsonist, and the supply func-
tion to a competitive industry.

a bureau that discriminates among factor suppliers will have an equilibrium output twice that of a competitive industry and will generate no profits or surplus value.

A comparison of the supply and cost conditions is also helpful. A monopoly has no supply function; it will set an output such that marginal revenue equals marginal cost, with the output sold at a uniform price. A bureau also has no supply function; it will exchange increments of output at the demand price for each increment to an output level such that the budget equals the minimum achievable costs or the marginal value of the increment is zero. In a sense, a bureau also has no separate marginal cost function. The incremental resource withdrawal for a budget-maximizing bureau will be equal to the demand value, as the difference between this value and the minimum incremental cost will be financed from the consumer surplus appropriated at lower output levels. Only if a bureau is efficient at lower output levels, for whatever reason, would the incremental resource withdrawal be equal to the minimum incremental cost. One implication of this condition is that an analyst may not be able to identify a demand-constrained bureau's minimum cost function from budget and output behavior. All this may yield is the bureau's estimate of its demand function; in the static case, all bureaus will appear to have declining marginal costs and in a sense they do. An estimate of a demand-constrained bureau's minimum marginal cost function must be constructed from detailed estimates of the production function and factor costs—creating an extraordinary demand for analysis.

For different reasons, in summary, both private monopolies and bureaus operate in output regions that are inherently nonoptimal. The substitution of a bureau for a monopoly to provide some product or service, however, solves no problems; this substitution will reduce the aggregate surplus value and serve only the interests of the owners of specific factors.

IV. *Effects of Changes in Demand and Cost Conditions*

The model outlined in Section II may also be used to estimate a bureau's response to changes in demand and cost conditions.

Demand Shifts. Figure 2 illustrates the changes in a bureau's equilibrium output and budget, for given cost conditions, in response to shifts in demand.

In the budget-constrained output region, the output of a bureau will grow by more than the amount of a demand shift, even when faced by increasing marginal costs. A bureau producing an output at constant marginal costs will grow at twice the rate of a competitive industry under the same conditions. In this region, the budget per unit output
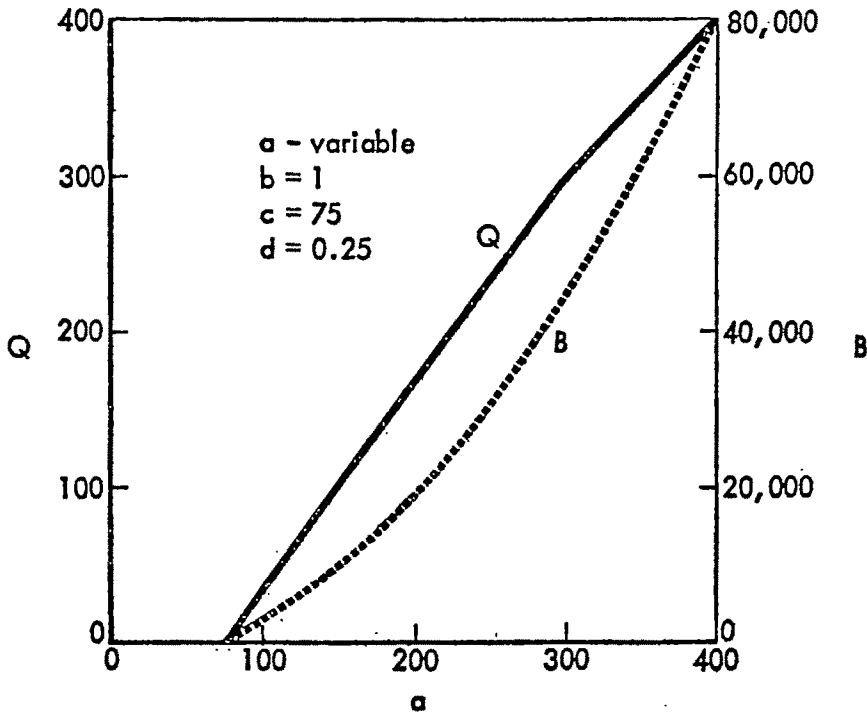
FIGURE 2
EFFECTS OF DEMAND SHIFT

will increase only by the amount of the increase in the minimum unit costs.

In the demand-constrained output region, the output of a bureau will grow by the same amount as the demand shift, regardless of the slope of the minimum marginal cost function. The slower rate of growth of a bureau in this region is still higher than the rate of growth of a competitive industry facing increasing marginal costs. In this region, the budget per unit output increases rapidly, by an amount proportionate to the demand shift, regardless of the slope of the minimum marginal cost function.

A bureau, like a private monopoly, will often find it rewarding to try to shift its demand function. The incremental budget that would result from a demand shift will be particularly high in the demand-constrained output region. One would expect, therefore, that bureaucrats would spend a significant part of their time on various promotional activities, supported by the owners of specific factors.

Changes in the Demand Slope. Figure 3 illustrates the changes in a

bureau's equilibrium output and budget, for given cost conditions, in response to changes in the slope of the demand function. The indicated changes in the intercept and slope are such that the output of a competitive industry, given the same cost conditions, would be constant at a level of 100 for each combination.
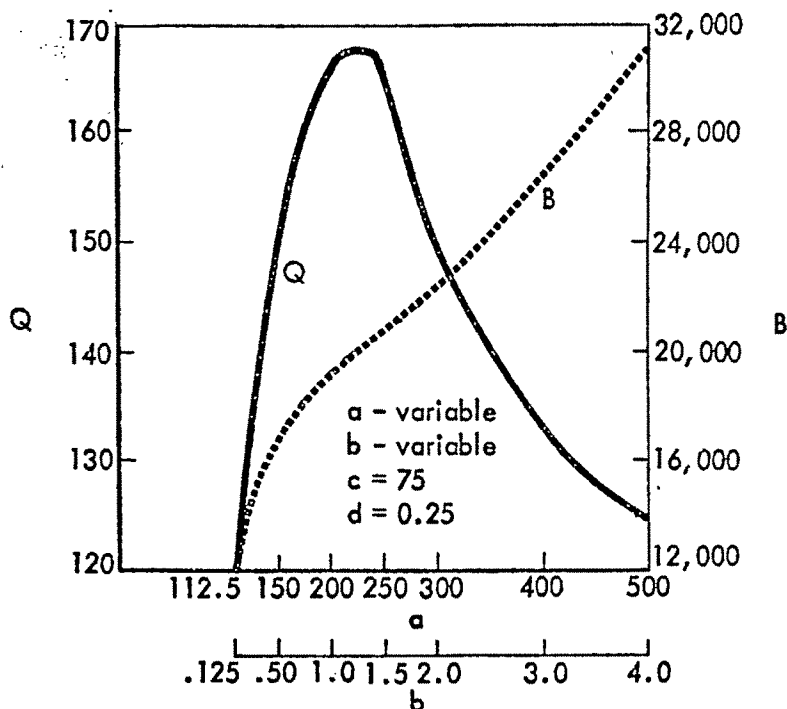
FIGURE 3
EFFECTS OF CHANGES IN THE DEMAND SLOPE

In the budget-constrained output region, the equilibrium output of a bureau will increase with increasing (negative) demand slopes; in the demand-constrained region, output will decline with increasing demand slopes. A bureau faced by a nearly horizontal demand function will produce an output at a budget per unit output only slightly higher than that of a competitive industry, but the total budget and the budget per unit output will increase monotonically with higher demand slopes. This suggests that a bureau may find it rewarding to try to increase the slope of the demand function for its output by promotional activities citing public "need" or military "requirement" to be fulfilled regardless of cost. A more important suggestion is that a bureau operating in a highly competitive output market would be relatively efficient. However, the present environment of bureaucracy—with severe constraints

on the creation of new bureaus or new outputs by existing bureaus, and the passion of reformers to consolidate bureaus with similar output—seems diabolically designed to reduce the competition among bureaus and increase the inefficiency (and, not incidentally, the budget) of the bureaucracy.

Cost Shifts. Figure 4 illustrates the changes in a bureau's equilibrium output and budget, for given demand conditions, in response to shifts in the minimum marginal cost function.
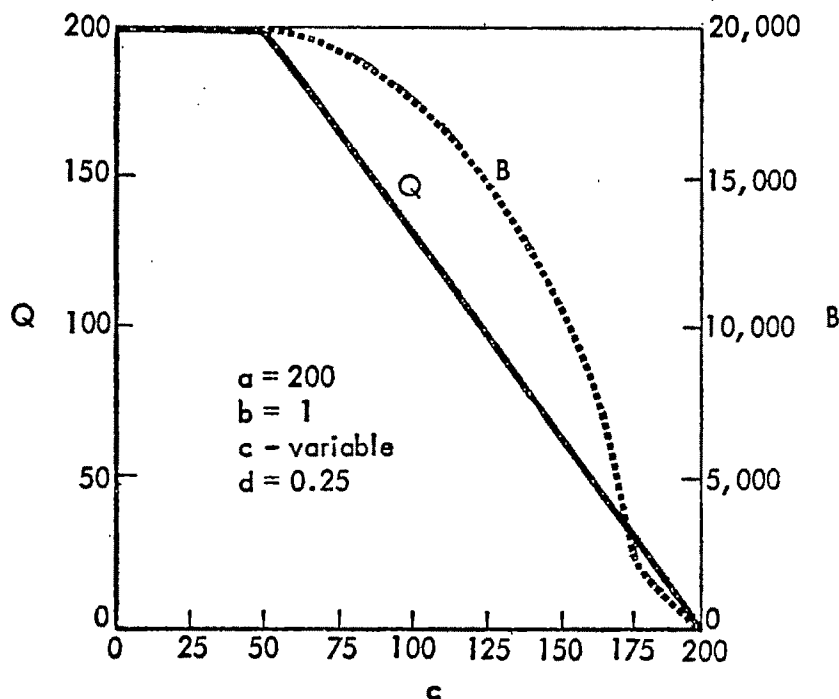
FIGURE 4
EFFECTS OF COST SHIFTS

In the budget-constrained output region, a downward shift of the minimum marginal cost function will increase the equilibrium output of a bureau at a rapid rate. A bureau producing an output at constant minimum marginal cost will grow at twice the rate of a competitive industry for the same downward cost shift. The bureau's budget will grow rapidly with the initial cost reductions and then very slowly as output approaches the demand-constrained output level. In the higher output region, further reductions in cost will not increase either the equilibrium output or budget.

These effects suggest that new bureaus or those facing exogenous

increases in costs will be very cost conscious. Such bureaus will have an incentive to determine their minimum marginal cost function and to try to reduce the level of this function. Older bureaus or those facing a rapid increase in demand couldn't care less on either count. Tullock has been intrigued by the observation that bureaus both attempt to reduce costs and manifestly waste huge amounts of resources. This model
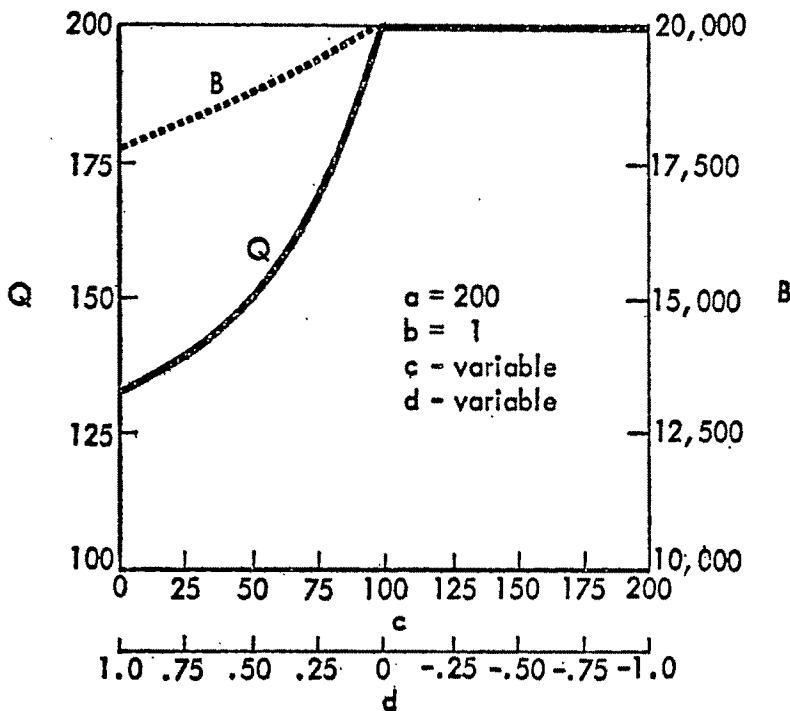
FIGURE 5

EFFECTS OF CHANGES IN THE COST SLOPE

suggests that, in equilibrium, a single-product bureau will be in one or the other of these conditions. A multiproduct bureau, such as Department of Defense, should be expected to attempt to reduce costs on the budget-constrained outputs and to assure that costs are sufficiently high to exhaust the obtainable budget on the demand-constrained outputs.

Changes in the Slope of the Minimum Unit Cost Function. Figure 5 illustrates the changes in a bureau's equilibrium output and budget, for given demand conditions, in response to changes in the slope of the minimum marginal cost function. The indicated changes in the intercept and slope are such that the output of a competitive industry, given the

same demand conditions, would be constant at a level of 100 for each combination.

In the budget constrained output region, the equilibrium output of a bureau that buys factors on a competitive market will increase with a reduction of the slope of the minimum unit cost function to a level, with constant unit costs, that is twice the output of a competitive industry. The bureau's budget will also increase with a reduction in the slope of this function, but relatively slowly. Both output and budget are invariant to changes in the slope of the cost function in the demand-constrained output region.

These effects suggest that bureaus may have an incentive to use production processes with a higher cost at low output levels and a lower cost at high output levels. In the static case, however, this incentive is not very strong and may be offset in part by pressure through the legislature from the owners of specific factors.

V. *Critical Tests of This Model*

This model suggests an image of a bureau with a level and rate of growth of output that is up to twice that of a competitive industry facing the same conditions. Demand by consumers may be the basis for establishing a bureau, but the interests of this group in preserving the bureau will diminish or disappear as the bureau creates no consumer surplus, except by negligence. A bureau, however, creates a substantially larger factor surplus than would a competitive industry, and the primary interests in continuing the bureau (or a war) are likely to originate from the bureau itself and the owners of specific factors. In the demand-constrained output region, a bureau's only concern about costs is to assure that they exhaust the obtainable budget. A bureau should be expected to engage in considerable promotion, in cooperation with the owners of specific factors, to augment the demand for its output, and to reduce—through persuasion, restrictions on entry, and consolidation—the elasticity of this demand.

These are serious charges. A set of critical tests of these assertions are difficult to pose. The best tests that I can conceive are to compare the output and costs of a bureau with those of a private firm with the same type of product. A comparison of the Social Security Administration and insurance companies, public and private hospitals, public and private statistics gathering organizations, or public and private police and garbage disposal services may be sufficient. Such tests, however, will be difficult as the existence of potential competition may present the bureau with a highly elastic demand, and some of the private firms producing a similar product have some of the characteristics of bureaus. A test of these assertions about a bureau that is the sole producer of a

set of products, such as the Department of Defense, is even more diffi-
cult and probably more important. For such bureaus, an internal com-
parison at different points of time or, possibly, with bureaus producing a
similar product in another political jurisdiction could be made.

VI. *Further Implications for Analysis and Policy*

Analytic Developments. The static model of a single-product bureau
outlined in Section II should be extended in several dimensions. First,
the consequences of the time-dimension of budget maximization should
be developed. Louis DeAlessi's preliminary analysis suggests that a
bureaucrat's concept of his property rights will lead to a preference for
capital-intensive production processes. Second, the behavior of a multi-
product bureau that receives a single budget (or several budgets not
specific to product type) should be explored. And third, the behavior of
"mixed" bureaus, such as the Post Office, educational institutions, and
public hospitals should be explored.

Policy Implications. This model of a bureau, if the suggested tests fail
to disconfirm its assertions, has important implications for the organiza-
tion for the production of the large and increasing proportion of our
national output now produced by bureaus. What changes could be made
to improve the efficiency of the production of these goods and services?

First, and probably most interesting, bureaucratic provision of these
goods and services could be maintained, but each bureau would operate
in a competitive environment and face a highly elastic demand function.
The creation of new bureaus would be encouraged. Existing bureaus
would be permitted and encouraged to produce products now pro-
vided by other bureaus. "Antitrust" restrictions would prevent collu-
sive behavior to divide products or output among bureaus and to pre-
vent the dominance of one bureau in a single product. The legislature
would be willing to shift some part of the output of one agency to an-
other, based on output and budget performance. The resulting bureauc-
racy would consist of many single and multiproduct bureaus without
any obvious relation (in use) of the products offered by any single
bureau. (As such, it would look a little like the corporate sector of our
economy.)

Second, the incentives of bureaucrats could be changed to encourage
them to minimize the budget for a given output or set of outputs. For
example, the salaries of the top 5 percent of the personnel of a bureau
could be a negative function of the budget of a bureau for a given set
of outputs. This would still permit a political determination of the out-
put level for the combination of bureaus providing the same product.
Such a system would require more precise measurement of output than
now, but would not require the monetary valuation of this output.

Such a system may also attract better managers to the bureaucracy.

Third, the type of goods and services now provided by bureaus could be financed through government or foundations as is now the case, but the provision of these services would be contracted to private, profit-seeking economic institutions. The bureaucracy, as such, would disappear, except for the review and contracting agencies. This system would also require better measures of output than now, but better measures are necessary for improved efficiency under any organizational form.

SOME ORGANIZATIONAL INFLUENCES
ON URBAN RENEWAL DECISIONS*

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Prescribing "corrective actions" for "market failures" is not a new activity for economists. Such corrective actions usually amount to the replacement of a market mechanism by some other mechanism such as a governmental agency charged with certain powers and responsibilities. Curiously enough, we know less about the behavior of these alternative institutional arrangements than we do about market institutions. It is hoped that this paper will add some insights into part of the workings of one such mechanism: the urban renewal program.

Parts of the behavior of two separate political bodies within the urban renewal institutional framework will be examined. The first will be that of the federal Urban Renewal Administration (URA). The second will be that of the local public agency (LPA) which represents the community. With respect to URA it will be argued that the particular institutional structure has influenced the locational distribution of urban renewal activities on one hand and the time sequence of project approvals on the other. With respect to the localities it will be argued that the institutional structure has influenced the method by which the local share of the project is paid.

The central theme about the workings of a political process is drawn from the works of Downs,[1] Tullock,[2] and Wildavsky.[3] Individuals within political processes must be responsive to the wishes of those who can control their future within the organization either directly or indirectly by means of financial control. Otherwise they will not survive. This is not really so different in principle from a market in which the seller must consider the tastes and alternatives of his customers if he is to continue as a seller. •

The Urban Renewal Administration

Because of the particular method of financing urban renewal (sometimes called the "back door" method), those who have the greatest influence on the amount of available funds can be rather easily identified.

[1] Downs, *Inside Bureaucracy* (Little, Brown and Co., 1967).
[2] Tullock, *The Politics of Bureaucracy* (Public Affairs Press, 1965).
[3] A. Wildavsky, *The Politics of the Budgetary Process* (Little, Brown and Co., 1964).

Bills including the amount of urban renewal authorization are acted upon by the Congress after having passed through the banking and currency committees. Once the funds are authorized, however, URA can effectively bypass the appropriations committees and Bureau of the Budget for much of its financing. Limited only by the amount of congressional authorization, URA has the authority to sign contracts with local public agencies which guarantee the payment of a certain amount of funds at the completion of a project. These contracts can then be used by the locality as collateral for project financing. When these contracts become due there is little the appropriations committee can do but appropriate the funds. Thus, in essence, URA has access to the full amount of congressional authorization. Even though this does not mean the appropriations committees have no control over urban renewal expenditure; it does mean, however, that the members of the banking and currency committees have a rather direct control over the magnitude of URA activities.

On the basis of this institutional fact it is conjectured that the Urban Renewal Administration is responsive to the desires of members of the banking and currency committees. It is assumed that a congressman desires more projects and spending in his district.

An examination of the membership of the 1964 banking and currency committees reveals that the 50 percent of all states which are represented on these committees receive almost 80 percent of all urban renewal expenditures[4] at the federal level. Population could be used as a reasonable explanation for this but population cannot be used as an explanation if it is found that urban renewal activity tends to be centered in congressional districts which are represented on the House Banking and Currency Committee. In making this comparison, several problems are encountered. First, the interests and influences of congressmen elected "at large" are not easily identified. Second, the constituents of a congressman may benefit from urban renewal projects which are not in his district. A representative from New York City or Philadelphia may be very interested in urban renewal in his metropolitan area even though it is not in his district. Furthermore, the data do not indicate the particular congressional district of projects in metropolitan areas when there is more than one congressional district in that area. So, failure to include all projects in a particular metropolitan area which has more than one district as projects in which a representative from one of those districts would be interested, would result in an underestimate of the interests of this particular representative. On the other hand, if all projects in a metropolitan area with more than one district

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[4] Project here refers to all projects for which "Part I" of the application has been approved.

are credited to just one member of the House, a population bias enters the analysis. Finally, some projects could not be assigned to a congressional district since the data source did not give the location of the project within the state, and other projects are located outside of the United States.

Suppose, first, that members of this committee from metropolitan areas with more than one congressional district are directly interested in all projects that occur in that metropolitan area. In this case, as shown on Table 1, the 7 percent of the House members which are on this committee have a direct interest in 25 percent of all urban renewal expenditures. If we delete from the sample all metropolitan areas with more than one district and all congressmen elected "at large," we find that the 5 percent of such congressmen on the House Banking and Currency Committee receive about 10 percent of urban renewal expenditures.

It appears that there is a relationship between membership on the House Banking and Currency Committee and urban renewal expenditures but both qualifications and refinements are needed. First, the reliability of the data is questionable.[5] Second, if membership on the committee influences URA decisions, the relevant data are urban renewal expenditures at the time the districts were represented. Third, the Banking and Currency Committee deals with many things other than urban renewal. Districts which have interests in these other things might also be those districts which are the most likely candidates for urban renewal. Hence, even if there is a relationship between committee membership and urban renewal, the relationship may not be due to an "advantage" in gaining URA grants provided by committee membership. The other activities of the committee may attract districts with a "relatively great" urban renewal "need."

In order to deal with the second of these problems, one needs to consider only those expenditures which occurred in a district at the time it was represented. The third problem offers more complications.

The data allow the following distinctions to be made among the districts: (i) the district was represented on the House Banking and Currency Committee at least one time during the 1949–64 period; (ii) the district received at least one project during the period; (iii) the district is not in a metropolitan area with more than one district; (iv) the district is located in a metropolitan area with more than one district.

Assume that districts which were ever represented on the committee (districts which have characteristic (i)) are more likely to have economic

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[5] Problems of this nature are due to changing boundaries and definitions as well as frequently inadequate descriptions at the sources employed.

TABLE 1

URBAN RENEWAL ACTIVITIES IN DISTRICTS OF HOUSE BANKING AND CURRENCY COMMITTEE MEMBERS, 1964

Committee Membership •	Number	Dollar Value
Number of members on committee $\frac{31}{435} = .0712$ Total House membership	Total projects in district or metropolitan area of committee members $\frac{294}{1872} = .1570$ Total projects	$\frac{1,025,690,541}{4,065,128,551} = .2523$
Members on committee minus committee members "at large" $\frac{28}{413} = .0677$ Members of House minus House members "at large"	Total projects in district or metropolitan area of committee members $\frac{294}{1690} = .1739$ Total projects minus projects in states with only House members "at large" minus projects in areas not in states	$\frac{1,025,690,541}{3,813,008,749} = .2689$
Members on committee minus committee members "at large" minus committee members from metropolitan areas with more than one representative $\frac{18}{329} = .0547$ Members of House minus members of House "at large" minus House members from metropolitan areas with more than one representative	Total projects in district of committee members other than projects in metropolitan area of committee members that contains more than one district $\frac{133}{1406} = .0945$ Total projects minus projects in states that contain only representatives "at large" minus projects in areas not in U. S. minus projects in metropolitan areas containing more than one district	$\frac{1,025,690,541 - 761,054,831}{3,813,008,749 - 1,192,637,852} = \frac{264,635,710}{2,620,370,897} = .1009$
	Total projects in district of committee members other than projects in metropolitan area of committee member that contains more than one district $\frac{130}{1396} = .0931$ Total projects minus projects in states that contain only representative "at large" minus projects in areas not in U. S. minus projects in metropolitan areas containing more than one district minus projects "at large" in state	$\frac{264,635,710}{2,619,376,627} = .1010$

SOURCES: *Congressional Directory*, 1964; *Urban Renewal Project Directory* (Washington: Government Printing Office, Sept. 30, 1964). Detailed documentation can be supplied by author upon request.

characteristics which make them better candidates for urban renewal than districts which have never been represented. If it is assumed further that all districts with property (i) are equally likely candidates for urban renewal, then one can calculate the expected proportion of all spending in districts with characteristic (i) which should have occurred in such districts at the time of representation.[6] There are variations of this theme. Perhaps it is more reasonable to assume that districts (i)$\wedge$(ii)$\wedge$(iii) are equally likely candidates for urban renewal. Likewise, it can be assumed that districts with characteristics (i)$\wedge$(ii)

TABLE 2

EXPECTED EXPENDITURES IN DISTRICTS AT THE TIME OF REPRESENTATION ON THE HOUSE BANKING AND CURRENCY COMMITTEE COMPARED WITH ACTUAL EXPENDITURES

Definition of the set of Districts "D"	Expected Expenditures* in Members of D During the Period of Representation as a Percent of Expenditures in All Members of D	Actual Expenditures in Members of D During the Period of Representation as a Percent of All Expenditures in Members of D
(i)	.370	.77†
(i)$\wedge$(ii)$\wedge$(iii)	.369	.71
(i)$\wedge$(ii)$\wedge$[(iii)$\vee$(iv)]	.378	.77†

(i) The district was represented on the House Banking and Currency Committee at least one time during the 1949–64 period.
(ii) The district received at least one project during the 1949–64 period.
(iii) The district is not in a metropolitan area with more than one district.
(iv) The district is located in a metropolitan area with more than one district.
* Approximately.
† These figures are the same by definition.

$\wedge$[(iii)$\vee$(iv)], or equivantly (i)$\wedge$(ii),[7] are relatively "homogeneous" with respect to urban renewal "needs." This latter set is affected by the problems of "overrepresentation" as was explained above.

On Table 2 the expected expenditures in districts at the time of representation were calculated under all of the above sets of assumptions and are compared with actual. In all cases it was expected that about 37 percent of the expenditures should have occurred during the time of representation. However, about 70 percent of the expenditures took place at the time of representation.

[6] Let $|D|$ be the number of elements in a set D of districts with the desired properties. Let $|R_i|$ be the number of elements in that set, $R_i CD$, of districts which are represented on the committee in year i. Let S_i be the expected expenditures in year i in districts contained in D and assume the expected expenditure is that which actually occurred. Then the expected expenditures during the 1949–64 period in districts of D at the time of representation is

$$ESR = \sum_{i=49}^{64} S_i \frac{|R_i|}{|D|}.$$

The expected proportion is

$$ESR \bigg/ \sum_{i=49}^{64} S_i.$$

[7] If a district was ever represented, it is either in a metropolitan area with more than one district or it is not.

Even though these data support the idea that URA caters to the source of funds, there are alternative explanations for the statistics. For example, perhaps members of the committee have more insight into the internal functioning of URA and are thus able to advise their constituents on dealings with the agency.

The Timing of Decisions

The works of Otto Davis and others indicate that bureaus in general are placed in a rather peculiar situation with regard to the timing of decisions. Decisions made by those who provide funds to the bureau are usually made near the beginning of the fiscal year. The material used for evaluation is in part the annual statistics of the previous year's activities. For the bureau this means several things. First, a given budget must be allocated over a year—the bureau's activity of providing services does not directly provide a stream of income as is the case with a firm. The entire budget cannot be spent during the first part of the year. Otherwise, there would be no justification for employment during the latter part of the year and the bureau would be without funds to meet unforeseen contingencies such as, for example, favors for important committee members. Yet, the bureau must spend most or all of its budget unless it wishes to face budgetary cuts the following year.

All of this indicates that expenditure decisions will proceed slowly during the first part of the year and increase during the latter part of the fiscal year when more of the opportunity costs are known.

In the case of the Urban Renewal Administration four types of decisions are of particular interest. Communities apply to URA for aid. This application shall be called an "original request." The URA then decides whether to approve the application or not. This decision will be called an "original approval." During the life of a project the community may decide to expand the project or it may find that the original grant was going to be insufficient. Regardless of the motivation the locality sometimes decides to request more aid. This decision shall be called a "revised request" and approval by URA is termed "revised approval." The final decision which is of interest is the decision that the community has actually satisfactorily completed the project and that the funds should be disbursed. This decision is called a "disbursement."

The nature of the actions taken on all completed projects in Region 2 as of April, 1965, were examined. There were fifty-one projects which represented about 30 percent of all projects completed in the United States at that time.

In support of the theory it was found that the month of June is the time of most decision-making activity by the URA as shown on Table

TABLE 3

DATES OF URBAN RENEWAL DECISIONS PERTAINING TO ALL COMPLETED PROJECTS IN REGION II, BY MONTH AND TYPE OF DECISION, APRIL, 1965

Type of Decision	Month											
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
Original request	5	5	11	1	4	2	3	2	6	3	2	7
Original approval	1	1	3	4	5	6	4	1	8	2	3	14
Revised request*	2	3	5	1	4	5	4	8	4	12	5	8
Revised approval	3	2	3	4	2	6	3	6	7	4	7	11
Disbursements	0	2	3	1	0	1	0	1	1	5	2	34
Total	11	13	25	11	15	20	14	18	26	26	20	74

* Revised requests are frequently submitted together with a request for disbursements. Such data are not included here.

SOURCE: Housing and Home Finance Agency, Urban Renewal Administration, Region II Office, Philadelphia.

3. However, during the last three months of the fiscal year almost one-half of all revised requests were made by the locality. This tends to support an argument that URA encourages communities to revise their requests during the latter part of the fiscal year. It appears as though the agency starts the year by making few decisions, and then picks up the pace during the latter part of the fiscal year.

Table 4 will aid in casting additional light on this activity. The same fifty-one projects are represented according to the time the application was acted upon by URA and the percentage of the request granted by the URA. When URA acts during the first part of the fiscal year most localities are given exactly what was requested while a few are marked

TABLE 4

PERCENTAGE OF GRANT REQUESTS MADE DURING CERTAIN PERIODS OF THE
YEAR THAT FALL INTO THE VARIOUS CATEGORIES OF SUCCESS. ALL
COMPLETED PROJECTS IN REGION II, APRIL, 1965*

Period of Year	Percentage of Request Accepted by URA				
	Below .96	.98	100	1.02	1.04 above
July, August, September, October......	14.28	4.76	76.19	0	4.76
November, December, January, February......	18.75	9.37	59.37	6.25	6.25
March, April, May, June............	27.65	8.51	46.80	8.51	8.51

* Data include all decisions made on all completed projects in Region II as of April, 1965, other than disbursements and revised requests made for disbursement purposes.

SOURCE: Housing and Home Finance Agency, Urban Renewal Administration, Regional Office II.

down. However, when actions were taken during the latter part of the year the approval was likely to be for either more than was requested or considerably less. This supports the idea that URA is changing its spending criteria in order to spend the proper amount of funds. This is done by encouraging localities to apply for additional funds, being "lenient" with the good projects, and approving at reduced amounts projects which are really "marginal."

If URA actually encourages applications near the end of the fiscal year, it must also approve those applications before the end of the fiscal year. And as was argued above, it will also tend to approve those applications with which it has been having "trouble" or those requests that have "been around" a long time. The requests are presented on Table 5 according to the time URA approval was received and the time that had elapsed since the request was made. Both as a percentage and in absolute terms, decisions made during the latter part of the

TABLE 5

PERCENTAGE OF APPLICATIONS FOR GRANTS ACCORDING TO TIME TAKEN FOR URA
DECISION AND ACCORDING TO PERIOD OF THE YEAR, APRIL, 1965*

Period of Year	Number of Months Taken for URA Decision		
	0–3	4–7	8 and over
July–August...............	$\dfrac{4}{8} = 50.00\%$	$\dfrac{2}{8} = 25.00\%$	$\dfrac{2}{8} = 25.00\%$
September–October........	$\dfrac{7}{13} = 53.84\%$	$\dfrac{4}{13} = 30.76\%$	$\dfrac{2}{13} = 15.38\%$
November–December......	$\dfrac{4}{17} = 23.52\%$	$\dfrac{7}{17} = 41.17\%$	$\dfrac{6}{17} = 35.29\%$
January–February......·...	$\dfrac{2}{14} = 14.28\%$	$\dfrac{5}{14} = 35.71\%$	$\dfrac{7}{14} = 50.00\%$
March–April.............	$\dfrac{9}{18} = 50.00\%$	$\dfrac{2}{18} = 11.11\%$	$\dfrac{7}{18} = 38.88\%$
May–June...............	$\dfrac{16}{29} = 55.17\%$	$\dfrac{4}{29} = 13.79\%$	$\dfrac{9}{29} = 31.03\%$

* Data include all decisions made on all completed projects in Region II as of April, 1965, other than disbursements and revised requests made for disbursement purposes.

SOURCE: Housing and Home Finance Agency, Urban Renewal Administration, Regional Office II.

fiscal year tend to be made on either "very recent" applications or "very old" applications. Presumably the recent applications were those sought by the agency and the old applications are the marginal cases.

Of course, these data "prove" nothing. In fact, given the nature of the conjectures, it is difficult to imagine what type of data would provide an adequate test. Nevertheless, the observations are strongly in agreement with the conjecture that the way urban renewal decisions are made strongly affects those decisions.

The Local Decision

The third decision process within the urban renewal framework which is of interest is that used by the locality. Generalizing about the decision process at the local level is even more difficult than at the federal level. There are many different processes which vary according to states and even according to the localities within states. Because of this diversity, the best way to describe the local decision process is in terms of the exhaustive set of channels, instruments, or actions open to an antagonist

(someone against urban renewal) to change, modify, or "kill" a proposal. This set is defined by the institutional framework of the decision process and may contain such elements as a "public referendum," or "pressure on a city planning commission which has veto powers," etc. Since this set is exhaustive, it represents the set of "hurdles" that advocates must overcome in order to be a successful coalition.

If the set of hurdles contains the element "unanimous rule," no change could take place unless the set of antagonists is empty. The process of choosing a proposal is, of course, logrolling, and the nature of the set of hurdles indicates the types of compromises that might be made in the system while a successful coalition is being formed.

With respect to urban renewal decisions, the number and nature of hurdles differ between states and sometimes between communities within states. In general, they can be classified as: the creation of a local public agency; the formulation of an urban renewal plan; the financing of a plan; and the acceptance of a plan.

The first hurdle that stands in the way of urban renewal advocates at the local level is the declaration by the community of a need for urban renewal and the establishment of a local public agency (LPA). This action, in several states, can only be done by the authority of a public referendum.[8] Other states, with a few exceptions,[9] stipulate that this can be done by a majority of the local governing body.

It appears that a referendum requirement for the establishment of an LPA would be no harder for "advocates" to overcome than a requirement that such measures must be passed by an elected local governing body. Mayors and city councils, if indifferent to the program itself, would simply try to do what the majority of their electorate wanted. A public referendum would simply make more accurate the estimation of the wishes of a majority. In the absence of a referendum a local public official could just as easily overestimate the number against the program as underestimate. Likewise, if the local public official was not indifferent, personally, toward urban renewal, he could be an advocate just as easily as he could be an antagonist. Furthermore, it would be just as easy for antagonists to influence the few individuals of a city council as the advocates. Neither is furnished with an existing organization or a subsidized source of funds with which to organize them-

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[8] California requires a majority vote for the establishment of an LPA (after July, 1961). This is also a requirement in the states of Maine, Mississippi (after 1962), Missouri (in towns with populations less than 75,000), Nebraska (in towns with populations less than 150,000), New Hampshire (in "towns"), Texas, Vermont, and Virginia.

[9] Florida and New York require that a special state legislative act is needed before any city, town, or municipality can exercise urban renewal powers. Illinois requires that communities must have the approval of the State Housing Board before exercising the powers while Wisconsin requires that the local governing body must pass such approval by a two-thirds vote rather than a majority.

selves. So, there is no a priori reason to expect either to be successful.

A referendum requirement does increase costs to both advocates and antagonists to the extent that they now need not only persuade and inform the governing body but also the class of indifferent people. In another sense, however, referendum requirements reduce coalition costs. Except to the extent that the class of indifferent people can be influenced, there is no need for forming a coalition. The coalitions form automatically at the ballot box. This implies that there is no need for advocates or antagonists to identify themselves to each other. Each individual can simply express his preferences when he votes.

The second major hurdle is the preparation of a plan. The importance should not be underemphasized. The plan is the actual motion which is to be accepted or rejected. It is by the plan that the actual basket of goods representing various concessions from all parties which take place in a logrolling process are represented. The individuals who control the plan actually control the alternatives faced by the decision-makers. In effect, those who control the alternatives faced by the decision-maker control the decision. Decision-makers who do not have the authority to make amendments to proposals or make alternative proposals actually do not control the variables which they are supposed to control as decision-makers. They can be placed in a situation similar to an "all or none" situation in the theory of demand. It is important to note the means by which proposed plans can be amended.

In most cases it is the primary responsibility of the LPA to prepare the urban renewal plan. If no other individuals in the community have the authority to amend this plan without the consent of the LPA, the advocates are placed in a very strong position since it is likely that the LPA members are strong advocates. State laws are unclear on this point.

Means for altering proposed plans, other than by direct amendment by the local governing body, frequently exist. For example, pressure might be applied through a city planning commission or similar agency. In some states a city planning commission has considerable authority over both the area to be redeveloped and the characteristics of the proposed urban renewal project.[10] Other states either do not require recommendations from a planning commission, or, if such recommendations are required, they are not binding.

It may be possible to pressure members of the LPA itself. The LPA serves under, or perhaps consists of, a board of supervisors. This board controls all employment within the LPA and it is with the members of

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[10] California and Maine require that the plan be certified by the city planning commission. Failure of the commission to approve the plan necessitates a two-thirds vote of the city council for acceptance of the plan. States requiring the approval of the planning commission as a necessary condition for the initiation of the plan are Connecticut, Indiana, Kentucky, and Pennsylvania.

the board that the authority of the LPA rests. If local decision-makers are unable to exert pressure on this group, either directly or through its own decision process to amend plans, a major source of compromise is eliminated.

The most obvious way that a decision-maker can exert pressures directly on the board for amendments to a plan is by the threat of removal. This alternative, however, is not open in all states. This also differs according to whether the local public agency is a housing authority or an urban renewal agency. In most instances the board is appointed by either the mayor or the local governing body, and those who appoint are able to remove. This pattern is not consistent, however. In some states the LPA officials can be removed only by the governor or a state board of housing in case the LPA is a housing authority.[11] In two states, the state can appoint and remove at least one member of a redevelopment agency,[12] and in one state, Indiana, all removals are made by the circuit judge. As a result, one can expect that LPA's in areas where the mayor or the local governing body have little ability to remove the officers from their positions, the local decision-makers have much less latitude over the range of alternatives they face with respect to urban renewal.

Finally, the advocates must get the approval of the decision-makers. Generally, there are two basic ways "approval" of an urban renewal plan is given. First, the state law may stipulate that the local governing body, itself, has the authority to approve transactions and activities of the LPA without resorting to a public referendum. A referendum is the second method of approval.[13]

If no public referendum is required, some definite implications can be deduced. Lack of the need of a public referendum establishes a decided advantage for the advocates.

Unlike the period during the establishment of the LPA, when the pressures on the local governing body were symmetrical, after the establishment of the LPA no such symmetry exists. The reason for this lies in the costs of decision making. For a group to identify themselves, to get together and to make a collective decision, requires funds, organization, etc. These institutions, however, are activities of a public nature. That is, the institution for making decisions is itself a type of collective good which the market, when left to its own processes, will leave in insufficient supply.[14] Such an institution is estab-

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[11] Illinois, Delaware, Georgia, Massachusetts (one member is appointed by the State Housing Board), New Jersey (one member is appointed by the state director of housing).

[12] Illinois and New Jersey.

[13] States requiring a public referendum for all urban renewal projects are Mississippi, Montana, and Vermont.

[14] This point was made by Mancur Olson, Jr., "Discussion Paper," *A.E.R.*, May, 1964, p. 251.

lished and financed by the locality for the advocates in terms of the
local public agency. No such institution exists for the antagonists.
Thus, the establishment of the LPA creates for those who desire the
program an advantage in getting any particular proposal accepted.

If no referendum is required, those who are antagonists must invest
funds, not only in communicating with the governing body, but also
in finding each other for the purposes of forming a coalition which can
present a position and objection to the governing body. They must
invest in showing the governing body that they are a majority, and
this requires knowing who are antagonists. This requires investments.
If a referendum is required, no such investment is necessary.

It should be pointed out that there are two separate effects. Once
the local public agency is established there is created an advantage for
the advocates. This is due to "coalition costs" being furnished by the
government. Regardless of the method of approval, by referendum or
by ordinance, this advantage remains. A referendum, however, reduces
coalition costs to the antagonists relative to the advocates.

The method of approval often depends on how the project is financed.
If certain types of noncash grants are used as payment for the local
share of net project cost, the project to be constructed on the area might,
itself, require authorization by referendum only. Several states require
a public referendum on all bond issues. This requirement can differ
between communities and according to the purpose of the issue. If the
means of financing the project are subject to a referendum, a good
chance arises for the antagonists to exert their influences and gain con-
cessions, if not kill the complete program.

Even though the existence of referendum requirements for bond issues
may not completely stop an urban renewal program, it may put an-
tagonists in a relatively strong bargaining position; thus necessitating
considerable concessions on the part of the advocates. If a strategy is
available to the advocates which would avoid the necessity of a referen-
dum, they would certainly adopt it.

This reasoning implies, also, that where no public referendum is
necessary, the program should more nearly approximate the wishes of
the advocates—those of the community with the strongest urban re-
newal preferences. Here we can get some idea of what the tastes of
strong advocates might be.

The local share of an urban renewal project can be paid by means of
cash grant or a noncash grant. The noncash grant can be in terms of
site improvements such as streets, sidewalks, sewers, planning, housing,
etc., or public utilities such as parks, schools, playgrounds, parking
lots, civic centers, bridges, etc. It can be argued that strong urban
renewal advocates would be more likely to pay for the project with

cash or site improvements rather than utilities of a more "public" nature. So, if a referendum is required, it would seem more likely that the local share would be paid in terms of "public works" as opposed to cash or "site improvements."

A hypothesis of this nature was tested. Data from all applications submitted to the Regional Office Number II, for which Part I of the Loan and Grant Contract has been approved by April 25, 1965, were collected. The projects were divided into those for which a public referendum of some type was required and those which faced no such constraint.[15] For each project, the amount that actually must be raised by the community was calculated. This means that state contributions, land donations, and tax credits were deducted from the local share. This remaining amount was either paid out of increased taxes, general revenue funds, capital improvements budgets, or bond issues. If a referendum of any type was required for the raising of the funds, the project was classified as one on which a vote occurred.

After the funds were raised, they could pay for the project with cash, project improvements, and demolition grants, or the construction of some type of public utility. The hypothesis states that if a vote is required, the funds would not be used as cash or site improvements. Rather, the funds would be used for the provision of some type of public utility.

For each project, the percentage of the funds raised by the locality which was used as a cash payment was computed. The percentage of the funds raised by the locality which was used for the provision of public utilities was computed. The results are shown on Table 6. For the average project on which a vote was required, 43 percent of the local requirements were met by the construction of a public utility. For the average project on which no vote was required, 18.5 percent of the local requirement was paid by constructing public utilities. The median percentage paid by projects on which a vote was required was 35 percent as.opposed to less than 5 percent for those on which there was no vote.

On the basis of this result, it can be argued that where the local public agencies are able to avoid public referendums, there is less need for them to attach urban renewal to some form of public utility in order to get the program passed. Where there exist referendum requirements, a successful proposal must be one which makes greater concessions to individuals who have relatively weak urban renewal preferences. Urban

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[15] The question of the reliability of the data cannot be overemphasized. The reports that were submitted to the regional office were often unclear as to different referendum requirements and actions. Where there was no indication of referendum requirements, the datum was eliminated. However, if there was some type of plausibility for one or the other categories, the datum was classified. Only a questionnaire to each community could really establish a good classification. This, however, was not done.

TABLE 6

PROJECTS DISTRIBUTED ACCORDING TO PERCENT OF LOCAL SHARE PAID BY MEANS OF THE CONSTRUCTION OF PUBLIC UTILITIES AND ACCORDING TO VOTE REQUIREMENTS, 1965

| Percent of Local Share Paid in the Form of Public Utilities | Number of Projects | | | |
| | Vote Required | | No Vote Required | |
	Number	% Total	Number	% Total
5	36	34.9	55	59.2
10	4	3.8	3	3.2
15	1	1.0	1	6.4
20	3	2.9	2	2.2
25	4	3.8	1	1.1
30	2	1.9	5	5.3
35	3	2.9	1	1.1
40	4	3.8	2	2.2
45	5	4.8	1	1.1
50	2	1.9	3	3.2
55	1	1.0	4	4.4
60	3	2.9	2	2.2
65	4	3.8	1	1.1
70	3	2.9	2	2.2
75	4	3.8	0	0
80	3	2.9	1	1.1
85	4	3.8	1	1.1
90	2	1.9	1	1.1
95	3	2.9	0	0
100	12	11.6	2	2.2
Totals......................	103	99.2	93	100.4
Mean......................	43.0		18.5	
Population Mean.........31.3				

renewal will be accepted by these individuals as a "free good" which accompanies the construction of public utilities, but they are unwilling to make cash outlays for urban renewal alone. Thus, little cash is used as payment for those programs where a referendum is required.

Summary

Part of the problem of attempting to analyze nonmarket decision processes is that of abstracting from the maze of institutional facts and associated variables those that seem to characterize the process. In this respect it was argued that the institutional framework of the urban renewal program influences urban renewal decisions in the following way: (1) districts represented on the House Banking and Currency Committee are favored; (2) URA changes its criteria for project approvals according to the time of the year; (3) the lack of referendum requirements for individual projects at the local level favors the es-

tablishment of urban renewal; (4) referendum requirements on projects at the local level influence the nature and purpose of the projects.

On the qualifications side it is sufficient to say that the shortcomings of the data are severe. Further, there is really no postulated theory of quantitative relationships among the variables. As a result, the most that can be said at this point is that the conjectures are sufficiently supported to warrant further investigation.

DEMOCRACY AND DUOPOLY: A COMPARISON
OF ANALYTICAL MODELS

By James M. Buchanan
University of Virginia

This paper is scientific arbitrage. I propose to summarize analytical models in the theory of two-party politics and the theory of duopoly. The similarities in these two theories have been widely recognized, but a more systematic treatment incorporating recent developments may be useful.

I. *Duopoly Location in One-Dimensional Market Space*

If a fixed number of customers is distributed uniformly along a line, say a road, and if each customer is assumed to purchase a fixed quantity of a good, marketed at a uniform price by either of two duopoly firms, with the choice between firms determined exclusively by distance, profit-maximization criteria will insure that both of the firms will locate at the center of the distribution. If the latter is not uniform over space, both will locate near the median customer. This clustering theorem of duopoly location was initially advanced by Hotelling [11], and it can scarcely be challenged, given the strict assumptions of the model.

II. *Party Platforms in One-Dimensional Issue Space*

Many scholars, among them Hotelling, Black [2], Downs [8], and Tullock [13], have recognized that the basic clustering theorem on duopoly location has a precise parallel in two-party democratic politics. If a fixed number of voters can be arrayed along a single line, that is, if the model can be meaningfully treated as unidimensional, each party, so long as it is motivated solely by a desire for electoral success, will offer a platform described by its estimate of the choices of the median voter. In such models, the implicit dimension is distance along the left-right spectrum.

III. *Party Platforms in Two-Dimensional Issue Space*

Political choice is normally too complex for meaningful analysis confined to one dimension only. Two-dimensional models seem minimal, and even these may be helpful largely as they reveal characteristic features of many dimensions. Once a second dimension is introduced, the cyclical majority problem arises.[1] Initially, this problem seems to reduce the

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[1] The cyclical majority problem, the "paradox of voting," was discussed in detail by both Kenneth Arrow [1] and Duncan Black [2]. The general model for this discussion was uni-

FIGURE 1

generality of the clustering theorem. The party that succeeds in select-
ing a platform that mirrors the preferences of the median voter may find
itself defeated, in a straight majority vote, by a party with a nonmedian
platform.

The simple analytics are illustrated in Figure 1. Assume that there are
three voters, A, B, and C, whose optimally-preferred positions, defined
in two dimensions, x and y, are shown at a, b, and c. Other relevant
data about individual preference functions could be depicted by drawing
in the standard indifference mappings. From this set of mappings,
"contract" loci can be derived; these are indicated by the boundaries
of triangular area in Figure 1. Lines of optima can also be derived for
each person on each of the two issue variables. These are depicted in the
dotted lines of Figure 1. The intersection of middle lines of optima

dimensional. One way of defining a dimension, however, is in terms of observed results. If a
cyclical majority is revealed, some members of the group must have preferences that cannot be
arrayed so as to display single-peakedness. This amounts to saying that, for these persons, the
issue space is at least two-dimensional.

determines the median position of each of the two issues, point M on Figure 1. The same person need not, of course, hold the median position on all issues.

If party 1 adopts platform M, however, party 2 can respond by offering platform N, P, or Q (or any platform described by a position within any one of the three lozenges formed by drawing indifference contours through M). Any one of these will secure a majority over M. The familiar cycle emerges, and unless adjustments are terminated by some arbitrary rule, the party platforms will tend to shift continuously. While there is a limited area over which platform changes will range, there is no tendency for these to settle at or near one median position.[2]

IV. *Duopoly Location in Two-Dimensional Market Space*

The cyclical majority has its counterpart in the locational indeterminacy of the comparable duopoly model. Figure 1 can be used to demonstrate this. The two dimensions now become spatial coordinates, and A, B, and C are now prospective buyers (or groups of buyers) whose precise locations are determined by a, b, and c. If one firm locates at M, a second firm can easily secure two of the three customers by locating at N, P, or Q, or at any point within any of the three lozenges. There is no location where the second firm could capture all three buyers from the firm at M. In response to the location of the second firm, the first firm could shift from M and recapture one buyer. The locational pattern of the duopolists will never stabilize under these conditions. Firms will not cluster at the effective center of the space, although the shifting of location will be bounded.[3]

V. *Duopoly Location in Two-Dimensional Market Space, with Many Buyers*

The parallel between the cyclical majority problem and the locational indeterminacy in duopoly has not been emphasized, primarily because one of the implicit assumptions of the duopoly model has been that the number of buyers is critically large. Most economists who have worked with the duopoly problem have, more or less intuitively and without careful analysis,[4] extended the clustering theorem to two-dimensional

[2] The basic geometry of two-dimensional issue space was developed by Black and Newing [3], and, in quite a different context, by Ragnar Frisch [9]. For a recent, and more complex, treatment, see Charles Plott [12].

[3] In order both to simplify the exposition and to make the comparison between the two models more meaningful, I have in drawing Figure 1 made a critical assumption. Following Tullock [14] I have assumed that utility functions are symmetrical around the preferred positions. This means that the two variables are completely independent one from the other in individuals' preference functions. This device allows us to measure ordinal preferences in terms of distances from preferred positions. This assumption appears arbitrary in the party-platform model, but it is the standard one in location theory.

[4] See, for example, Chamberlin [4], p. 260.

space. This extension holds, as the following section demonstrates, only when the number of buyers becomes critically large.

VI. *Party Platforms in Two-Dimensional Issue Space, with Many Voters*

In relatively sharp contrast with duopoly theory, the theory of party-platform selection has been developed in small-number models. The paradox of voting has been almost universally illustrated in small-number examples, generally those with only three voters. This provided the basis for Tullock's [14] specific extension of the analysis to a critically large number of voters. If the electorate is expanded, the cyclical majority problem largely disappears because the internal space within which the cycle occurs becomes relatively very small. Given a sufficiently large number of voters, uniformly distributed over the two-dimensional issue space, the platforms of the two parties become almost identical. The full stability of the unidimensional model is not attained, but the area within which platform adjustments take place becomes small indeed. Practically speaking, the clustering theorem retains its validity.

VII. *Duopoly Location in Two-Dimensional Market Space, with Many Buyers, and with Finite Threshold-Sensitive Response*

Devletoglou [5] [6] [7] has explicitly challenged the clustering theorem of duopoly theory. In the context of a two-dimensional market space with many buyers, he has shown that profit-maximizing duopolists will locate at the center only on the presumption that buyers are hypersensitive to distance differentials. If buyers are assumed to respond only over a finite threshold, a minimum sensibile dispersion rather than center-clustering will characterize locational patterns.

The argument may be summarized briefly using the circular market space of Figure 2 to illustrate. Buyers are assumed to be uniformly distributed over this space, and each buyer is assumed to respond only if a threshold differential, RS, is crossed. Each person is indifferent as to which of the duopolists to patronize if these are located within RS distance of each other. Price, along with all other aspects of the product, are assumed identical for the two firms. It is apparent that, in this model, full center-clustering will make all buyers indifferent as between the two firms. This remains the case so long as the two firms locate closer together than RS. Some dispersion can, therefore, be predicted even in the model where buyers are assumed to be insensitive to changes in distance-costs and where firms are assumed to have no inventory costs.

Within the same basic model, where there is at least some distance-
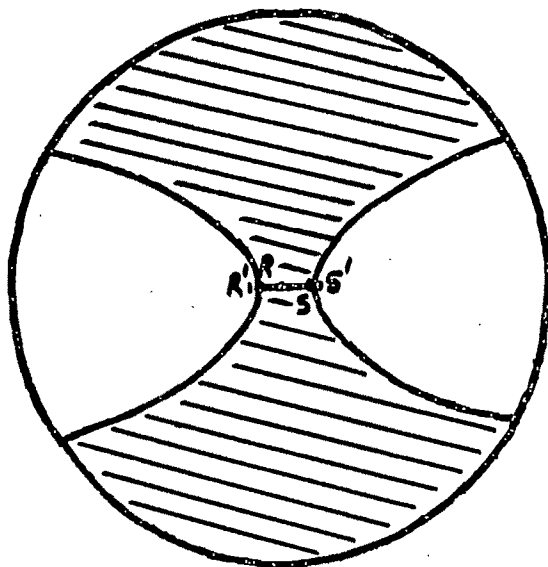
FIGURE 2

cost elasticity of demand, and/or where firms face positive costs of holding inventories, there will again be a specific profit incentive causing dispersion. As the two firms shift apart, beyond the minimum sensibile range, say to R' and S', the market divides into three distinct regions or parts. All buyers in the left-hand region attach themselves to r, the left-shifting firm; all buyers in the right-hand region attach themselves to s, the right-shifting firm; all buyers in the shaded area will remain indifferent as between the two sellers. For these, custom will depend strictly on chance elements. This construction makes it clear that if the total amount of the good purchased by a buyer increases as average distance is reduced and/or if firms find it advantageous to reduce the dependence of their own sales on chance, hence avoiding possibly violent shifts which make the carrying of large inventories necessary, some locational dispersion beyond the threshold distance will be generated by the profit-maximizing behavior of the duopolists.[5]

In his initial models, Devletoglou assumes that all buyers exhibit uniform thresholds of response to distance. As he shows, the basic conclusions do not require this rigid assumption. If all buyers are assumed to be threshold-sensitive, but the size of the threshold is assumed to increase proportionally with distance, an equally strong incentive is provided to the firms to disperse. Pressure for dispersion remains even when

[5] The specific locational pattern will depend on the strength of the various forces. The location of the firms will, in turn, fix the relative areas of the three regions, although the hyperbolic structure depicted in Figure 2 seems general given the central assumptions of the model.

the size of the threshold varies among buyers, so long as the distribution is assumed to be roughly similar as among separate regions of the market space. As the proportion of all buyers who are hypersensitive increases, or as the size of the average threshold diminishes, the pressures on the firms to disperse will, of course, diminish.

VIII. *Party Platforms in Two-Dimensional Issue Space, with Many Voters, and with Finite Threshold-Sensitive Response*

The introduction of finite threshold-sensitive response in the models of two-party politics offers promise, and it may be argued that voters are more likely to exhibit such implied quantum jumps in choice behavior than buyers. Analysis that parallels Devletoglou's can be applied directly.

Assume that many voters are uniformly distributed over the circular issue space of Figure 2, with the location of a voter carrying the same meaning as that earlier discussed. The two issues are assumed continuously variable and are measured along the abscissa and ordinate. Using Tullock's [14] examples, these can be thought of as appropriations for the Army and for the Navy.

If a minimum sensibile, a threshold of RS is again postulated for each voter's choice behavior, party platforms would tend to cluster only to the extent limited by this range, even in the complete absence of voter disaffection and party requirements for voter loyalty. If the two parties select platforms near the center of the space and within this range of each other, all voters will be indifferent as between the two parties. The outcome of a majority voting process will depend on chance elements.

Some voter disaffection should be expected, however, as party platforms diverge from preferred positions. A reasonable assumption is, therefore, that the percentage of eligibles who actually cast votes will decrease as the distance from the nearest of the two platforms increases.[6] Analytically, this assumption in the political model is equivalent to that of positive distance-cost elasticity of demand in the spatial duopoly model. When such voter disaffection is plugged in, each party will find it advantageous to move slightly beyond threshold limits. By so doing, it can pick up a somewhat larger share of voters in the sector of the issue space toward which it shifts.

This pressure for dispersion is increased when considerations of party loyalty are allowed. If a political party is a permanent or quasi-perma-

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[6] In an unidimensional model, Downs [8] demonstrated the tendency toward platform dispersion that this assumption generates. The argument has more recently been elaborated by Gerald Garvey [10]. Tullock [15] has extended Downs's analysis to the two-dimensional case.

nent organization, it can scarcely depend on chance elements for its basic financial and canvassing effort. At least some minimal core of loyal supporters will be desirable. In order to insure this, a platform must be selected that, for at least this minimum number of voters, the threshold is crossed. This need for party loyalty is on all fours with the existence of positive inventory costs in the duopoly model. And, just as in the latter, this reinforces the pressure for dispersion generated by voter disaffection. Party platforms will tend to differ to the extent that these elements prevail.

If the threshold of response is assumed to increase proportionally with
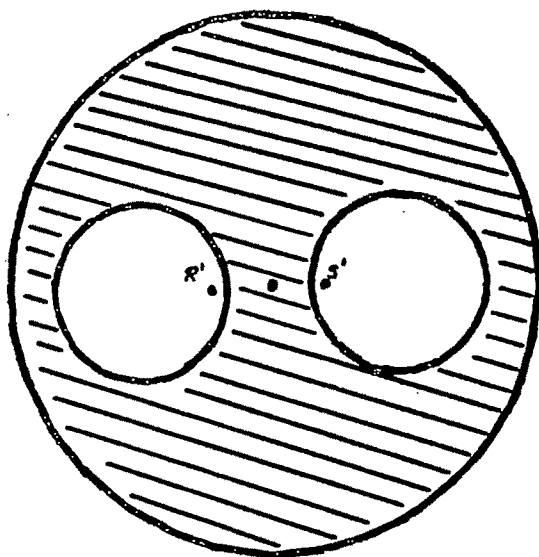
FIGURE 3

distance, the tendency toward dispersion remains, just as in the comparable economic model. Somewhat interestingly here, as Devletoglou has shown, the issue space again tends to divide into three distinct areas of the shapes shown in Figure 3. The pressure toward dispersion of difference between party platforms remains even when the size of the effective choice threshold varies among voters. There are no distinctions in these respects between this and the duopoly model.

As noted in Section VI, full center-clustering is not attained, with many voters, in two-dimensional models, even without threshold-sensitive response. The cyclical majority problem arises to generate continuous platform adjustments, but these are confined to a limited area near the center, and, for some purposes, these may be disregarded. The introduction of the threshold would seem to add somewhat greater stability to the model in this respect. Minimal platforms adjustments become less

productive to the parties, although the adjustments that are made will involve larger "jumps."[7]

The replacement of hypersensitive response by the threshold in the two-party model for political choice allows certain conceptually refutable hypotheses about institutional reforms to be advanced. Any change that reduces average voting costs—as, for example, the introduction of Sunday polling—should reduce the differences between party platforms. Similarly, any change that reduces party dependence on a core of loyal and financially able workers—for example, federal tax financing of presidential campaigns—should also reduce these platform differences.

IX. Welfare Implications

Only when the welfare implications of the two analytical models are compared does a significant difference emerge. To the extent that the duopolists are dispersed from the center of the market space, due to predicted threshold-sensitive response on the part of buyers, combined with distance-cost elasticity of demand and/or inventory costs, the average travel distance for all buyers in the space is reduced below that level which would be present under full center-clustering. If travel is not itself considered to be utility increasing, such a reduction can be taken to represent an increase in material welfare, in an admittedly limited sense. The dispersion from the center is, to this extent, therefore, welfare increasing.

This result is not forthcoming from the party platform model, for the obvious reason that only one of the two competitors can win an election. Here it is as if the duopoly firms compete for mutually exclusive rights to sell to the whole market. Instead of reducing average distance, in this case between the voter's most preferred combination and the winning party's platform, the dispersion increases this distance relative to that which would be present under center-clustering. Any dispersion, any introduction of differences between party platforms, tends, therefore, to be welfare decreasing, given the setting of the model.

By the nature of politics, at least in some ideal sense, the issues that are defined in party platforms represent proposals for general rules that are applicable for the whole community. Two competing governments, each of which is allowed to impose its own general rules, would seem to contradict the presumed necessity of such rules. When this is recognized, along with the possible welfare decreasing effects of platform dispersion, effort directed at reducing threshold-sensitive response of voters by making them more aware of, and sensitive to, differences in party plat-

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[7] Intuitively, the effects of threshold-sensitive response on the stability of adjustment seems apparent. But I leave the formal proof to Devletoglou or others.

forms seems socially productive. Relatively, such effort offers more "social" return than comparable effort in increasing the locational sensitiveness of market buyers. Inferentially, the analysis also suggests that there are potential welfare gains to be expected from measures designed to reduce the costs of voting itself and, also, from measures which tend to reduce the dependence of political parties on the establishment and maintenance of loyal groups of quasi-permanent supporters.

Insofar as threshold-sensitive response remains an important element in voter reaction, and, as a result of this and related factors, party platforms continue to differ measurably one from the other, the importance of party rotation in office is increased. The analysis allows this familiar principle of rotation to rest on a firm welfare basis. As noted above, by the very nature of political choice, one party and only one wins an election. It is thereby empowered to impose the general proposals contained in its platform upon all voters in the community, not only those who supported it in the election. Rotation provides the political analogue to the dispersed location of the two duopoly firms, each one of which caters to the specific market area determined by its location. If genuine rotation of two competing parties could be insured, some dispersion might be deemed welfare increasing even in politics, provided that welfare is measured in some dynamic sense.

X. *Conclusions*

None of the welfare implications or the policy suggestions inferred from these should be overemphasized. They were presented here primarily to indicate the potential usefulness of the analytical models. The main purpose of the paper has been that of simply tracing the parallels between two bodies of analysis. In both cases, the models remain highly abstract. Subsequent developments and extensions are apparent. In duopoly theory, a more systematic extension of the analysis to allow for an additional number of firms, perhaps moving from duopoly to triopoly to oligopoly generally, thence to n-firm competition offers great promise even if the analytical barriers are formidable. An extension of the political models to allow for multiple parties is also suggested, although, again because of the mutual-exclusion aspects of political choice, this extension is less relevant than in the comparable economic models.

There is also a need to expand and to extend both models to include additional dimensions. In duopoly theory, spatial location introduces only two of an almost limitless number of dimensions worth exploring, the single most important additional one being, of course, price itself. Similarly, with politics, party platforms embody proposals on many more than two issues. As the dimensions of the models are expanded, a

geometry of hyperspaces becomes necessary, and some shifting to less representational mathematics is indicated. With threshold-sensitive response models generally, there remains a gap between the aggregative constructions and those derivable by stages from analysis of individual choice behavior.

REFERENCES

1. Kenneth Arrow, *Social Choice and Individual Values* (John Wiley and Sons, 1951, rev. ed., 1963).
2. Duncan Black, *The Theory of Committees and Elections* (Cambridge Univ. Press, 1958).
3. Duncan Black and R. A. Newing, *Committee Decision and Complementary Valuation* (London: William Hodge and Co., 1951).
4. E. H. Chamberlin, *The Theory of Monopolistic Competition* (Harvard Univ. Press, 7th ed., 1956).
5. Nicos E. Devletoglou, "A Dissenting View of Duopoly and Spatial Competition," *Economica*, May, 1965, pp. 140–60.
6. Nicos E. Devletoglou and P. A. Demetriou, "Choice and Threshold: A Further Experiment in Spatial Duopoly," *Economica*, Nov., 1967.
7. Nicos E. Devletoglou, "Threshold and Rationality" (forthcoming).
8. Anthony Downs, *Economic Theory of Democracy* (Harper and Row, 1957).
9. Ragnar Frisch, "On Welfare Theory and Pareto Regions," *International Economic Papers*, Vol. 9 (London: Macmillan, 1959), pp. 39–92.
10. G. Garvey, "The Theory of Party Equilibrium," *Amer. Polit. Sci. Rev.*, Mar., 1966, pp. 29–39.
11. H. Hotelling, "Stability in Competition," *Econ. J.*, Mar., 1929, pp. 41–57.
12. Charles Plott, "Equilibrium and Majority Rule," *A.E.R.*, Sept., 1967, pp. 787–806.
13. Gordon Tullock, *The Politics of Bureaucracy* (Washington, D. C.: Public Affairs Press, 1965).
14. ———, "The General Irrelevance of the General Impossibility Theorem," *Q.J.E.*, May, 1967, pp. 256–70.
15. ———, *Toward a Mathematics of Politics* (Univ. of Michigan Press, 1967).

DISCUSSION

STEPHEN ENKE: Dr. Niskanen has introduced us to an important area that needs much further exploration. His paper is not simple to understand—even when supplemented by oral elaboration. Part of the difficulty is that, before one considers the algebra and geometry, one needs to know more about the institutional setting.

The setting that Niskanen has in mind is that of a bureau director, who maximizes his own personal satisfactions by maximizing his bureau's budget, and plays a sort of game with those who determine his bureau's level of funding. In effect, this director promises some future output for some future budget. What he promises by way of output is based on what budget he believes he can get. He does not promise more output than is attainable from what he considers a realizable budget grant. He always spends his budget. If he gets more budget than he needs to produce the output required of him, he does not necessarily produce more but may waste inputs deliberately.

The bureaus Niskanen has in mind often do not sell their output but provide it gratis. If they sell output, they do not sell at a uniform price. If they obtain revenues, these are not respendable by them.

What are the economic consequences of this particular definition of a government bureau and concept of its director's motives?

First, Niskanen asserts that bureaus exchange some total output for some total budget, which leaves the "market" with an all-or-nothing choice, vesting the bureau with monopoly power over outputs and/or monopoly power over factor inputs. This discussant's view is rather that a bureau's budget is varied from year to year by small amounts. Even a supposedly "pure" bureau such as the Department of Defense does not suggest for itself an appropriation of either $70 billions or $0. Practically, government bureaus are very limited in their ability to discriminate among the suppliers of most factors used—government procurement and hiring regulations are replete with rules against just such behavior. (Anyway, if bureau directors wish to maximize budgets rather than outputs, they surely are never motivated to discriminate and sometimes may be motivated not to discriminate.)

Second, Niskanen distinguishes those cases where the bureau is demand-constrained rather than budget-constrained, in the sense that it has sufficient budget to provide an output having a marginal use value of zero or less. But what is this demand? Is it the director's estimate of demands by users of the bureau's output, in which case it would be negatively inclined as the paper suggests? Or is it some derived demand, seen by Congress, for instance, in which case it takes the form of at least an appropriated budget or at most an output-price rectangle? Perhaps the Niskanen scenario is that bureau directors try to persuade Congress that the direct users' demand is always further to the right, justifying more funds.

Third, where a bureau is budget-constrained, Niskanen states that the equilibrium output (allegedly without "fat") will be higher than the Pareto-optimal level (which is correct) and will offset all of the user surplus that would be generated by smaller budgets and outputs (which is incorrect because users do not ordinarily pay for output and certainly not at its marginal cost). Graphically, this equilibrium is where the rectangle *efgi* equals in area the polygon *eahi*, or where the minimal marginal cost curve (C) intersects a users' average valuation curve (shown by the line $\sum V/Q$, in the diagram below).

The rationale of such an output being "equilibrium" is not readily grasped. It must stem from Niskanen's view that the relevant budget is the area to some output under the V curve (which represents marginal value to consumers) and not the area to some output under the C curve (which represents minimum marginal costs of output). Apparently, whatever and whoever determine bureau appropriations, an attempt is made to ensure not only that the marginal cost equals average users' valuation but also that total variable costs are usually less than total users' valuation (because *ecgi* is always less than *efgi* if C is positively inclined).

Presumptuously, considering only no discrimination cases, this discussant offers a supplementary theorem. In the graph used here an average valuation curve ($\sum V/Q$) and an average cost curve ($\sum C/Q$) have been added. Otherwise this diagram is the same as Niskanen's Figure 1.

It is argued that directors seek to maximize output, because this means more users and hires, and that they only maximize budget as a means to that end.

Another institutional assumption could be that although directors cannot ordinarily get a budget that would provide a zero marginal value output, they do seek to persuade budget-makers that their bureaus should have more rather than less budget and output within this limit.

Should not their first attempt be to "sell" the idea that the "proper" output is that which will equate total use value and total cost? Graphically this is where the lines $\sum V/Q$ and $\sum C/Q$ intersect. This is a slightly higher output than Niskanen claims is "equilibrium" for a bureaucracy under these circumstances.

Next preferred by a director could be a budget and output that make average use value equal to minimal marginal cost (as Niskanen suggests).

Still less ambitious, the director might argue for a budget permitting a Pareto-optimal output such that marginal use value (V) equals marginal real costs (C). What does it matter if bureaus do in fact often spend budgets providing outputs such that minimal marginal cost equals average users' valuation? The significance is that, with linear V and a constant C this means outputs double what they should be according to a competitive norm. Thus they antisocially overproduce by about the same factor of two as a profit-maximizing firm is expected to underproduce.[1]

[1] One can imagine a marginal revenue curve lying halfway between the V line and the vertical axis, relevant to a profit-maximizing firm, and cutting C halfway to this axis from its intersection with V.
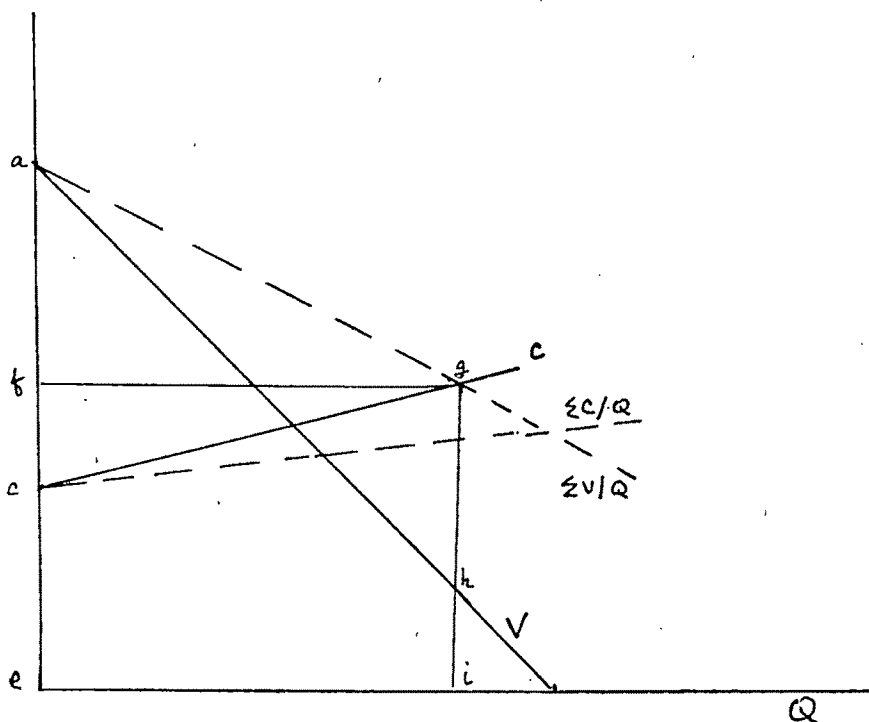
FIGURE 1

All in all, Dr. Niskanen has given us a paper that raises more questions than it answers, which for such an unexplored subject as the "economics of bureaucracy" surely testifies to its value.

OTTO A. DAVIS: My remarks are confined to the paper by Charles R. Plott for two simple reasons. First, Plott's paper is my assignment. Second, it has turned out to be impossible for me to read the other two papers due to both a lack of the papers and a lack of time. This may be the first time that I have found it necessary to stick to my assignment.

In his introductory paragraph Plott remarks that economists have long followed the practice of prescribing "corrective actions" for "market failures," that these corrective actions usually consist either of the replacement of, or regulation of, the market mechanism by the actions of some governmental agency; and it is a curious fact that we know very little about the factors which might govern the actions of the agency. Indeed, it has only been very recently that inquiries into "nonmarket" decision making have been considered legitimate topics for economists to investigate. Hence, the profession now finds itself without an adequate basis for determining whether corrective actions result in situations which are in any sense better than those characterized by market failure. It is a simple fact of life for economists that the mere existence of market failure cannot be considered a legitimate reason, at least by itself, for deciding that cor-

rective action is desirable. One must also determine whether available remedies produce actual situations which are in any sense better than those which would have been obtained by tolerating the market failure.

In a very real sense the legitimate subject matter of economics has been incomplete. Without a theory of nonmarket decision making which is well developed, the economist is placed in the position of only being able to give advice whose value and worth is unknown and unknowable. Hence, there is some urgency in a plea for the development of a satisfactory theory or theories of nonmarket decision making. It is common knowledge, of course, that the development of such theory is only beginning, and this fact provides the proper perspective in which to view Plott's paper.

It has been known for some time that, at least theoretically, there does exist an argument in welfare economics which can be used to "justify" an urban renewal program. As can be inferred from the above remarks, however, this theoretical justification does not mean that there is a solid basis upon which an economist can professionally endorse the existing program or, indeed, any renewal program. In addition to the theoretical justification of welfare economics, one must also know the operating characteristics or principles of the agency which is charged with the conduct of the program before one can determine with a reasonable degree of certainty whether the program will actually result in an improvement in the uncorrected situation. While in retrospect one might examine the present program and conclude that on the whole it has resulted in a misallocation of resources, such a conclusion does not affect the major point here. Plott has provided and tested some organizational hypotheses about the operating behavior of the Urban Renewal Administration which, if they had been known before the program was put into effect, would have been most helpful in evaluating the actual outcome of the program. In this regard, Plott's paper is an excellent example of the kind of knowledge of the operating characteristics of governmental agencies which must be developed before the economist will be in a position to judge the probable outcome of the adoption of a program.

If it is presumed desirable for those of us interested in nonmarket decision making to proceed toward the development of a relevant theory or theories of the operating characteristics of governmental agencies, then a question arises which concerns the identification of the promising approaches toward this development. While there exists a continuum of nonexclusive possibilities, it is helpful here to contrast the two extremes. First, there is the pure theory approach which generally proceeds without regard for empirical testing. Second, there is the purely empirical approach in which there is no regard for theory. Plott's paper is not an example of either of these extremes. It represents the useful combination of hypothesizing and testing. It is precisely the kind of work which, in my opinion, will turn out to be the necessary basis for the development of a useful and relevant general theory of agency behavior. It is the kind of work which, in my opinion, is all too rare.

It is generally presumed that a discussant must make some sharply

negative and nasty remarks. Accordingly, it is possible to argue that Plott has committed a major sin of omission. He has not tied this analysis to welfare economics so that there would be a better basis for evaluating the urban renewal program. However, if we believe in the old observation that some specialization is desirable, then we cannot take this sin very seriously.

A second nasty remark, which some certainly take to be a serious charge, is concerned with the fact that the major hypotheses are not developed from general principles of individual behavior. Indeed, there is a school of thought which holds that the only legitimate method of conducting an economic analysis is to base the inquiry upon the axiom of self-interest and individual rationality. According to this school of thought, all interesting and useful hypotheses are derived from explicit or implicit maximization problems which are supposed to represent individual human behavior. Plott's hypotheses are not explicitly derived from maximization problems or general principles of rational individual behavior. This discussant, however, simply does not belong to this school of thought, rejects this criticism, and considers this view to be overly restrictive, too narrow a conception of analysis, and fundamentally wrong in refusing to acknowledge the simple empirical fact that some theories which are not based upon the axiom of individual rationality are both interesting and useful.

A third set of criticisms concerns some rather picayune matters. At one point Plott considers the issue of whether the relevant unit of analysis consists of the particular electoral districts represented on the banking and currency committees or of the metropolitan areas in which the members of these committees reside. A careful consideration of this issue might produce the following argument. An urban renewal project inherently produces adverse effects for some members of the community in which the project is located. These members are those families residing in the particular area of the project who find it necessary to relocate. Insofar as these persons are voters, the committee member might find that the project produces an additional base of strength for his opposition at the next election. Hence, for the committee member to favor the project, it must produce benefits for more voters than are adversely affected. This consideration forces an explicit demand that one identify just what constitutes a benefit from an urban renewal project. Plott uses the term "preferences for renewal." If this term is to be taken seriously, then it must be based upon the presumption that some voters identify with their metropolis, which is the usual frame of reference, to the extent that they feel benefited by observing the replacement of old and unsightly construction by new development. This observation must mean, however, that a congressman would tend to favor any urban renewal project in his own metropolis which resulted in the destruction of unsightly and dilapidated buildings, and he should be especially in favor of those projects which were near to his own district, but not directly in it, since all of his constituents could experience benefits from a nearby project whereas one in his own district would have the additional effect of producing negative benefits for at least a portion

of his constituents. This argument produces an additional hypothesis which might be subjected to empirical testing. It also suggests that the appropriate unit of analysis is the metropolitan area. It might be added, however, that this picayune argument does not detract from Plott's substantive results.

This discussant finds that it is necessary to conclude that Plott's paper is not only a contribution in and of itself, but that it is a relatively rare example of the particular blend of the development of theory and the careful execution of empiricism which has great promise for becoming the base upon which a general and relevant theory of agency behavior can be constructed. It is true that most of the studies in this area tend to be of the pure theory variety, and while their substantial value is not to be discounted, one can hope that the future will witness a dramatic increase in the number of studies which combine theory with empirical observation.

EARL A. THOMPSON: First, I have some critical remarks on both recent democracy theory and Hotelling-type location theory—remarks designed to indicate that Professor Buchanan's provocative attempt to merge these theories is more on the order of an attempt to merge Fred's laundry with Jack's shoe shop than it is to merge General Motors with General Electric.

The democracy models under consideration are those which concern the existence of a majority rule equilibrium (i.e., the nonexistence of a paradox of voting). For some strange reason, these models (e.g., Tullock, 1967, and Plott, 1967) deal only with choices between outputs of different Samuelson-type collective goods. But surely the distribution of private goods, at least via the determination of tax shares, should also be considered subject to the majority rule decision process. But once such decisions are admitted, a society can never possess a simple majority rule equilibrium! For suppose the initial distribution of a private good (e.g., leisure) between three individuals is represented by the positive, ordered set, (X_1, X_2, X_3). Always possible is a proposal generating (X_1+a, X_2+a, X_3-2a) and another generating (X_1-a, X_2+2a, X_3-a) for some $a>0$, keeping all other elements in the social choice the same. With disinterested voters abstaining, this would obviously imply a paradox of voting; so that no simple majority rule equilibrium can ever exist in a society containing a private good.

Hotelling-type location theory ignores all forms of price discrimination even though it assumes that there is a quasi-monopoly and a geographical separation of markets—conditions commonly regarded by economists as sufficient for locational price discrimination. Once the natural element of locational price discrimination is introduced, it is easy to see that the overclustering-of-duopolists result disappears. The reason clustering to a single point results in Hotelling's model is that when a firm moves closer to its competitor, it gains some marginal customers without losing any expected revenue from its hinterland customers (because these customers have completely inelastic demands at the firm's existing price). Since the

real losses to the hinterland customers in terms of increased transport costs
are not internal to the producer, there is an external diseconomy in the clus-
tering activity which produces overclustering relative to a Pareto-optimum.
Once rational price discrimination exists, the producer will charge his hinter-
land customers just what they are willing to pay (i.e., the transport cost
from the firm to the competitor plus the competitor's price) while charging
his nonhinterland customers prices which decline with their distances from
the competitor. Under these conditions, a firm internalizes what were pre-
viously losses to its hinterland customers when it moves closer to its com-
petitor. Indeed, the firm's privately optimal location is midway between
its customers, for any movement from that point would generate more
equal price decreases to the firm than it would equal price increases. And
since competition for these positions between the duopolists implies that
both have the same profits, this puts the equilibrium locations at the
quartiles of the location line—the socially optimal location points. This
type of price discrimination is commonly effected in the real world (despite
Robinson-Patman) by the firm's making free deliveries to customers close
to the shopping district.

I shall now discuss the particular points in Buchanan's paper. In my
opinion, the main assertions in Buchanan's paper are: (1) that the existence
result in the recent majority rule literature (Tullock, 1967) can be carried
over to a multidimensional location problem and (2) the results of the loca-
tion literature (i.e., Hotellin_t and Devletoglou) may be carried over to a
multidimensional, two-party democracy—only with under- rather than
overclustering of political party platforms.

Summarizing my discussion below, more accurate assertions would read:
(1) that it is the effective nonexistence result in the recent majority rule
literature (e.g., Plott, 1967) that can be carried over to a multidimensional
location problem and (2) that the results of the location literature can indeed
be carried over into some, as yet unspecified, two-party democracy model—
only without any a priori tendency toward under- or overclustering of
party platforms.

The existence conjecture of Tullock on which Buchanan bases his first
argument is not strictly correct. A continuum of voters with circular in-
difference curves between collective goods is neither necessary nor sufficient
for the absence of a cyclical majority problem. Rather, it is a symmetry
property regarding individual preferences—a property implied by Tullock's
assumption of uniformly distributed voters' optima—that is necessary and
sufficient. In the discrete case, Tullock's model is merely a special case with
circular indifference surfaces of the general model of Plott. Plott's general
theorem states that necessary and sufficient for the existence of a majority
rule equilibrium (the absence of a cyclical majority) is that for any indi-
vidual not on his optimum at the solution there is another individual with
an equal marginal rate of substitution between the two collective goods—
but with negative rather than positive marginal utilities. When indiffer-
ence curves are circles, this result obviously implies the directional sym-

metry of voters' optima (i.e., that for each voter whose optimum is not the equilibrium we can associate a unique voter whose optimum lies on the other side of a straight line connecting the first voter's optimum with the equilibrium).

It is clear that if the limiting process which generates a continuum of individuals requires that for each individual's optimum there be another individual's optimum which is directionally symmetric to it about the solution, then the joint density function which appears in the limit would require the analogous, remarkable property that the median of its conditional density function along any line drawn through the equilibrium is equal to the equilibrium. Joint density functions symmetric about the joint mean have this property, but apparently few other distributions do.

Thus, using the Plott result and its extension to the case with a continuum of individuals, Buchanan's general argument that the structure of the two arguments are equivalent argues against rather than for extending the Hotelling result into multidimensions.

Buchanan's second argument—that the conglomeration arguments of location theory can be applied to political parties—is no doubt correct for some specifications on a model for interparty competition. But since no such set of exact specifications was provided, there seems to be no basis for judging the empirical relevance of applying the Hotelling and Devletoglou arguments to political parties. My own hunch is that the basic Hotelling model, as a positive theory, is much more applicable to political parties than it is to duopoly location. For one thing, Hotelling's argument for one-point concentration fails for triopoly while there is no analogous reason for it to fail for three competing political parties. For another, the one-vote-per-man property of the majority rule model makes Hotelling's assumptions of no price discrimination and inelastic demand applicable in the political party model even though the assumptions are highly inapplicable to a location problem. (However, as Buchanan points out, variable voter participation rates would lend some elasticity to the response of voters to changes in their party's platform.) Finally, while rational expectations à la Von Neumann and Morgenstern would probably change the basic Hotelling result (which is based on a Bertrand expectation condition, which is irrational in a world with a small number of sellers), they would apparently have no such deleterious effect on a model of competing political parties.

This brings us to Buchanan's interesting claim with respect to the normative aspects of two-party competition; viz., that the opposite of the Hotelling overclustering result applies. I believe that Buchanan is saying that since there is only one majority rule equilibrium (which is basically a mistake, as we have argued above), both parties should announce that equilibrium as their platform. But, granting the unique majority rule equilibrium, the only apparent excuse for the existence of two parties would be the existence of imperfect information as to what constitutes the equilibrium. And if there were this imperfect information, one would hardly describe the

social optimum as an allocation in which both parties tried the same platform. Still, the Hotelling overclustering argument is not applicable, for when a political party confers losses on its extremist members by moving to the political center in order to capture the necessary number of middle-of-the-roaders, losses which are external to the party because these members will still give it their votes, there is likely to be an external benefit to the extremists of the other party. Such an external benefit of clustering is entirely absent from the Hotelling private-good world.

The length of this discussion is evidence of the provocativeness of Professor Buchanan's paper.

Here is another commodity which enters into the production of other goods, but which, like electricity, need not be transported from regional producing centers to the various regional markets. The reasons for including such commodities within the framework of the macroeconomic model are discussed in detail below. For the present it is sufficient to note that they are to be distinguished from the "located" commodities previously described.

TRANSPORT FOR ECONOMIC AND
SOCIAL DEVELOPMENT

SIMULATION OF TRANSPORT POLICY
ALTERNATIVES FOR COLOMBIA

By PAUL O. ROBERTS *and* DAVID T. KRESGE
Harvard University

Introduction

Economic development, like most other human endeavors, appears to be strongly influenced by transportation. Planning for transportation must therefore be closely integrated with general development planning in order to be effective. Over the past three years, the Transport Research Program in the John F. Kennedy School of Government at Harvard has developed a macroeconomic and transport model to explore the interface between the economy of an underdeveloped nation and its transportation system.

The macroeconomic portion of the model produces annual projections of regional demands, production levels, and incomes. The transport sector determines market areas, distribution and routing of these commodity flows, and assigns them to the links of a network representing the individual transport facilities existing or proposed for the country or region under study.

The operating characteristics of the transport system are determined, and objective measures of performance are obtained. These measures are then fed back to the macroeconomic portion of the model so that the interaction can be accounted for in subsequent time periods. This approach attempts to combine macroeconomic modeling with a detailed simulation of the transport system over multiple time periods so that alternative development strategies, pricing policies, and investment plans may be compared and evaluated.

The Macroeconomic Model

In its operational form, the macroeconomic simulation model handles an enormous number of variables and is extremely complex. The economic logic of the model is, however, relatively straightforward. The basic structure of the model can be outlined in just a few paragraphs or shown in a simple flow diagram, as in Figure 1.

The computations performed by the model can be divided into three major categories; final demand, industrial production, and income.
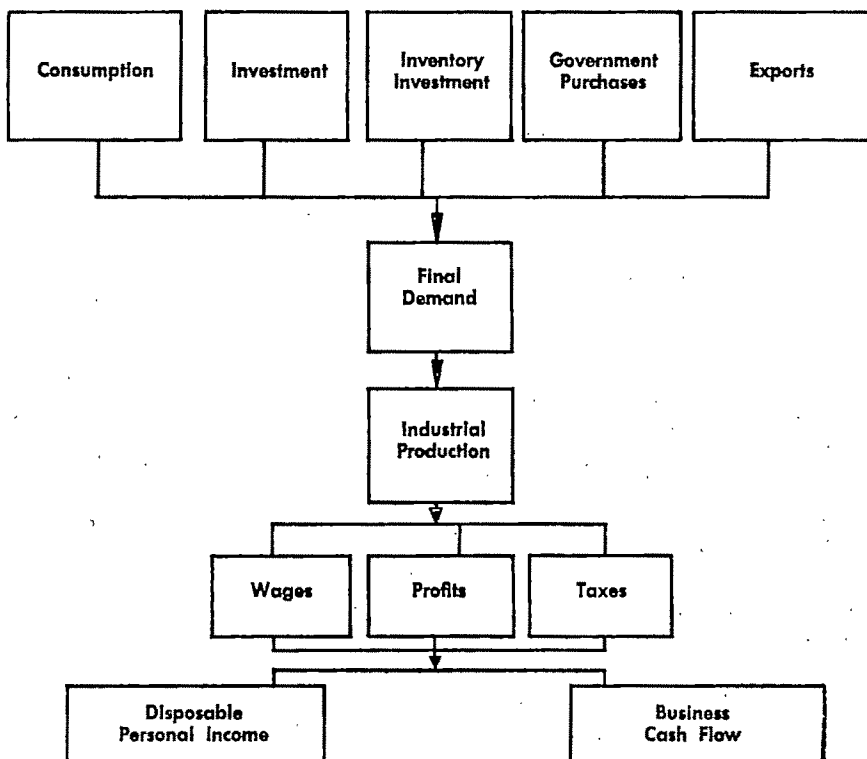
FIGURE 1

Final demand is composed of personal consumption expenditures, fixed investment, inventory investment, government purchases and exports. Within each of these categories, demand is estimated on the basis of individual commodities. That is, if the output of the economy is classified into ten commodity groups, final demand will be estimated separately for each of those groups. These estimates are largely based either on exogenous variables, such as government policy variables, or on the outputs and incomes of the preceding time period.

Given the final demand for each commodity, the model next uses an input-output table to compute the industrial production required to meet those demands. Finally, the third type of computation determines the distribution of income associated with the estimated levels of industrial production. Wage payments are related to industry outputs, profits are derived from estimates of revenues and costs, and taxes are related either to output, wages, or profits, depending on the type of the tax. From the above it is possible to estimate disposable personal income and the cash flow to businesses. These items, together with the

output figures and the exogenous variables, provide the information required to carry the simulation into the next time period, at which point the computation procedure simply repeats itself.

The picture of the model given by this highly condensed outline is obviously far from complete. The outline does, nonetheless, provide a broad overview of the logical structure of the macroeconomic model. Disaggregation into geographic regions is, of course, necessary if the results of the model are going to be used for transport planning. Therefore, most of the relationships in the actual simulation model are specified on a regional rather than a national basis. The price that must be paid for obtaining regional information from the model is a sharp increase in the number of variables that must be manipulated and calibrated. Also, the need to estimate regional output and interregional commodity flows adds a fourth major category of computations to the model.

With the introduction of regional variables, the structure of the model appears as shown in Figure 2. The components of final demand are now computed on a regional basis. Total final demand for each commodity is obtained by summing the regional demands. As before, the input-output table is used to translate final demand into industrial production. Since there is virtually no hope of empirically estimating regional input-output tables, industrial production is here estimated on a national basis.

The next category of operations allocates the national industrial output to the various regions within the country. This information is used by the transport model to compute the flows of individual commodities from each region to all other regions. Using the interregional flows determined by the transport model, the macroeconomic model proceeds as before to compute incomes. These incomes, which are now computed regionally, again serve as inputs for the estimation of final demand in the next time period.

The Transport Model

The basic task of the transport model is to describe how the producers of commodities would use a given transport network to reach what they consider to be desirable markets. This implies a capability for simulating the behavioral aspects of market selection. The model has been designed, therefore, to approximate the aggregate behavior of a number of individuals, each acting in his own self-interest. Once this is done, commodity by commodity, the resultant network flows and the consequent costs can be determined both for using the network and for supplying transport facilities and services.

The principal means by which control can be exerted on the trans-
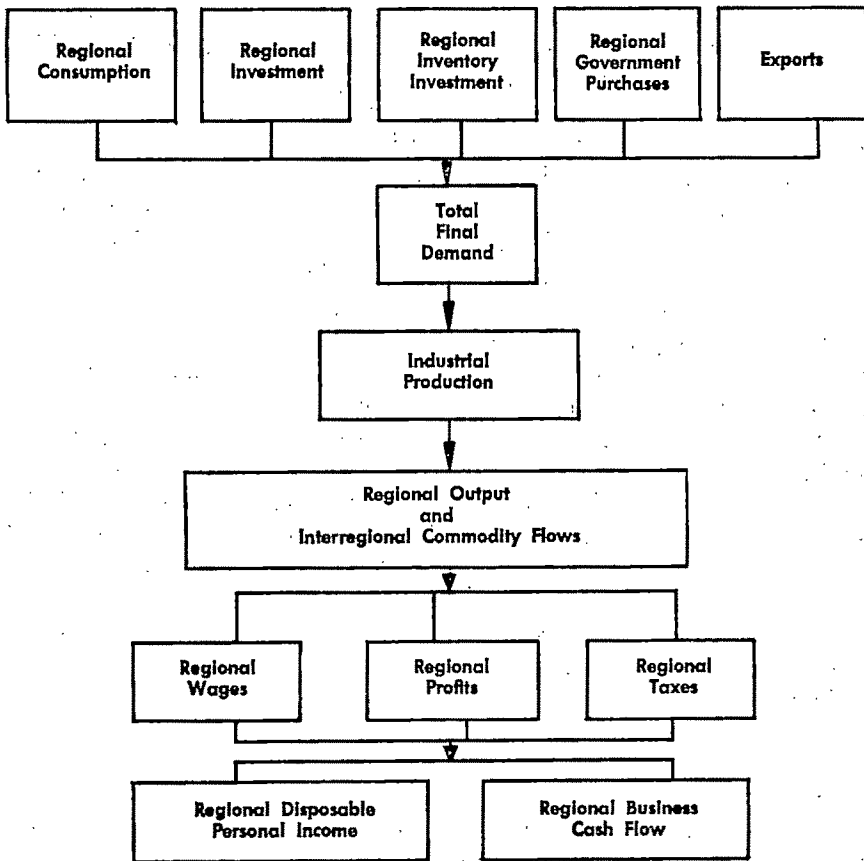
FIGURE 2

port model is through the selection of system additions or changes, including detailed changes in the characteristics of each link, and the specification of the number of vehicles and type of vehicles available. Since another important means of governmental control in developing countries is exerted through controlling the price of using the facility, pricing functions are also incorporated into the model.

The operations of the transport model can be broken down into eight suboperations: disaggregation, network editing, determination of modal choice and routing, commodity distribution, network assignment, modal cost-performance determination, pricing policy implementation, and transport summary. The interrelationships between these operations are shown in Figure 3.

The disaggregation of the supplies and demands generated by the macroeconomic model is performed first. Regional production and

Repeat for each year
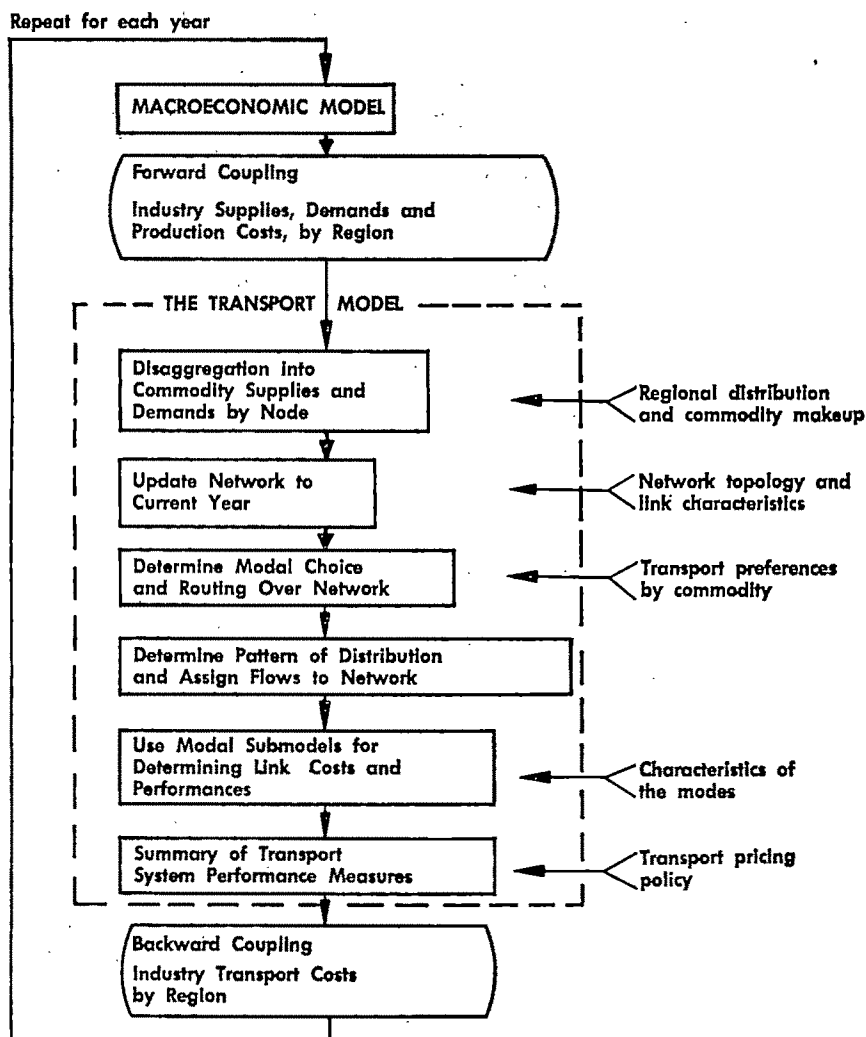
FIGURE 3

THE TRANSPORT MODEL AND ITS RELATIONSHIP TO THE MACROECONOMIC MODEL

consumption are disaggregated into seasonal supplies and demands by subcommodity at individual cities within each region. The disaggregation provides the additional detail needed by the transport model if transport policy is to be properly assessed.

The editing of the transport network is merely the yearly updating of changes in the link-node graph which serves as the representation of the transport network within the computer. By adding and deleting links or by making changes in the physical characteristics associated

with a link, various time-staged transport investment plans may be simulated.

Modal choice and routing are determined simultaneously. The shippers' choice of transport mode and routing is assumed to depend on a number of variously important cost and performance factors. A measure of the relative rating of each link from the viewpoint of the shipper of each subcommodity is obtained by taking the weighted sums of the cost-performance measures using the value weightings assigned to each cost-performance factor by the shipper. That routing over the network is chosen which minimizes total cost as defined by the rating scheme above.

The pattern of interregional sales is determined by the use of one of two alternative commodity distribution models. Total supply and demand figures for each subcommodity at each node are known. The problem is that of replicating the observed commodity flows from a few supply sources to a typically larger set of demand points. Currently available distribution models include a linear programming transportation model as well as the more common gravity model.

Once intercity flows have been determined, they are assigned to the network over the routings previously determined. Flows are accumulated link by link for all subcommodities. There is, within the context of a developing country, no need to perform assignments on a capacity restrained basis since the physical capacity of most facilities is rarely exceeded except perhaps in ports.

The determination of cost and performance link by link over the system is accomplished by the use of a series of modal submodels. There is a separate model for each mode which uses as input the physical characteristics of the link as specified exogenously by the system planner and the endogenously determined link flows. Performance is measured in terms of waiting time, travel time, variability of time, probability of loss, and cost. Cost is that expense required to furnish the transport service.

Cost to provide the service must be replaced by the price actually paid by the user before these cost-performance measures are used in the computation of modal cost and routing. A pricing function, incorporating an exogeneously supplied pricing policy, is used to relate price to cost.

Finally, costs by region and industrial sector are prepared for use by the macroeconomic model. A summary of transport system performance measures is also determined for use by the planner. The result of one year's operation now becomes the basis for the subsequent year. Operation of the model for the simulation of a particular economy is typically carried out over a multi-year planning or simulation period.

Description of Colombia and Its Transport System

For purposes of experimentation with the model, the country of Colombia, South America, was chosen. Its economy, while still less than fully developed, is by no means simple. In addition, Colombia has an outstanding transportation problem due to its topography and climate.

The principal topographical features are the massive Andes Mountains. From a single range at the Ecuadorian border, the mountains divide into three separate cordillera—all large and formidable from any point of view. The central and eastern cordillera increasingly separate northward to the Magdalena River Valley, forming another major topographic feature of the country. The valley is large with diverse climate ranging from relatively dry uplands to completely flooded tropical lowlands. To the east beyond the eastern cordillera is the Colombian Llanos, an area that is still largely uninhabited.

Colombia has an abundance of natural resources, not the least of which is its agricultural potential. The most important agricultural commodity is coffee. Coffee is grown in almost every region of Colombia, but in particular in the central highlands and north coast mountain regions. Other important export commodities include petroleum, livestock, bananas, cotton, and wood. Domestic production of food products including rice, wheat, bananas, potatoes, and a variety of vegetables and fruits is supplemented by imports of grain.

Colombia manufactures some domestic industrial goods, including steel and a portion of the consumer products which it requires. Most manufacturing is carried on in Bogota, Medellin, and Cali, though all major cities have at least some manufacturing. With the exceptions of textiles, clothing, and cement, very little of the manufacturing of Colombia is for exporting, but mainly for domestic consumption.

The transport sector is represented in Colombia by all the common modes of travel, including highway, rail, pipeline, river barge, ocean shipping, cabotage, and air. Exports and imports account for a relatively large percentage of total commodity movement. Shipment of petroleum accounts for approximately 60 percent of the total ton-miles of total freight movements. Passenger travel is not as significant in Colombia as it typically is in countries in more advanced states of economic development.

Because of difficult topography, the cost of constructing transportation facilities is high. The nature of the soils, the rainfall, and the drainage conditions also make maintenance of existing facilities difficult. Since the poor maintenance and difficult topography make operations costly, transportation costs are in many industries a significant part of the total costs of production.

*Description of the Model of the Economy
and the Transport System of Colombia*

The macroeconomic model of Colombia divides the economy into eleven separate geographic regions. There are 10 internal regions and 1 region representing the outside world. See Figure 4. The internal regions are reasonably well-defined economic units but are constrained to be aggregations of the political and administrative units or departments (analogous to a state in the United States). This was convenient from a data standpoint since most of the statistical files have information recorded by department. The economy has been divided into 9 separate industrial sectors which are aggregations of the 37 sectors in the 1956 input-output table for Colombia.[1] The 9 sectors are: agriculture and mining, livestock, coffee, foodstuffs, nonfood consumer goods, industrial goods, construction, services, and transport.

Within the transport model, these 9 economic sectors were disaggregated into 29 separate subcommodities. Some of the sectors, agriculture and mining in particular, were disaggregated into many subcommodities. For others, notably industrial goods, further disaggregation was impractical. Table 1 shows the correspondence between the sectors of the input-output table, the subcommodities in the transport model, and the products in Gilmore's study of interregional commodity flows in 1956.[2]

Disaggregation of the macroeconomic sectors is accomplished by means of exogenously specified parameters. Although too voluminous to show here, they perform the task of disaggregating the 9 sector economy into the 29 subcommodities at each of the 40 supply and demand nodes for each season. Changes in the disaggregation parameters were made through time, particularly in the petroleum sector.

The transport network was coded to include 40 points of production and consumption. Naturally there are several production and consumption points within each of the economic regions. These points along with the coded network representing the 1956 transport system are shown in Figure 5. Highway, rail, river shipping, pipeline, ocean shipping, and transfer links were included in the network. Air was not included because of space limitations within the computer.[3]

Models of the highway, rail, and transfer models were calibrated by reference to international as well as Colombian cost data published on

[1] This table was obtained from the Departamento Administrativo Nacional de Planeacion of the Republic of Colombia.
[2] Norman Gilmore, "La Demanda de Transporte de Carga en Colombia" (unpublished report of Departamento Administrativo de Planeacion, 1960).
[3] Because of the small volume of air travel relative to the other modes, it was handled separately.
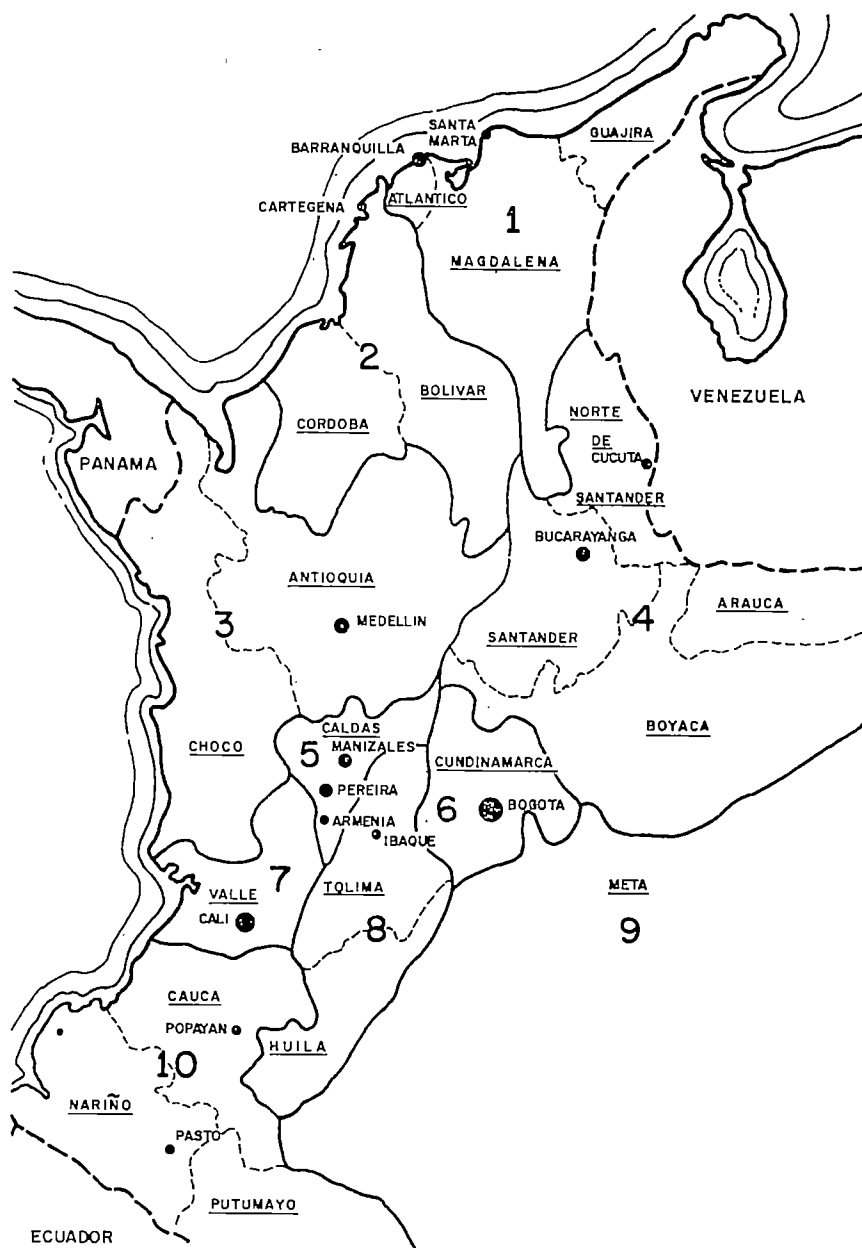
FIGURE 4

MAP OF COLOMBIA SHOWING REGIONS OF THE MACROECONOMIC MODEL AND
THEIR RELATION TO THE DEPARTMENTS

TABLE 1

CORRESPONDENCE BETWEEN PRODUCTS IN THE GILMORE STUDY, SUBCOMMODITIES
IN THE TRANSPORT MODEL AND INDUSTRIES IN THE MACROECONOMIC MODEL

Macroeconomic Model Industries	Transport Model Subcommodities	Gilmore Study Products
1. Agriculture and mining	1. Bananas	Bananas
	2. Potatoes	Potatoes and Yucca
	3. Sugar	Cake sugar
		Refined sugar
	4. Other agriculture	Cotton
		Forrage crops
		Beans
	5. Grain	Rice
		Rye
		Wheat
		Corn
Mining	6. Oil	Crude petroleum
	7. Other mining	Coal
		Peat
		Firewood
		Lumber
2. Coffee	8. Coffee	Coffee (processed)
	9. Cafe	Coffee (green)
3. Livestock	10. Cattle	Cattle
4. Foodstuffs, slaughtering, beverages and tobacco	11. Foodstuff	Drinks
		Beer and alcoholic beverages
		Flour
		Malt
		Other foodstuffs
5. Nonfood consumer goods, handicraft, textiles, footwear and clothing, wood and cork, wooden furniture, pulp and paper, printing and engraving, leather and footwear	12. Handicraft	
	13. Light industry	Newsprint
6. Industrial goods, rubber, chemicals, petroleum and coal derivatives, minerals (nonmetallic), basic metals, metal products, machinery, electrical articles, transport equipment, other industries	14. Refined products	Gasoline
		Kerosene
		Fuel oil
		Oil and grease lubricants
		Asphalt
	15. Minerals	Salt
	16. Metal	Iron and steel
	17. Heavy industry	Glass
		Cement
		Machinery in general
7. Construction	18. Construction	
8. Public utilities, commerce, banking, housing and other services	19. Services	
9. Transportation	20. High income passenger	
	21. Low income passenger	
	22. Government	

TABLE 1—(*Continued*)

Macroeconomic Model Industries	Transport Model Subcommodities	Gilmore Study Products
	23. Transport	Transport material
	24. Investment	
	25. Air	
	26. Ocean	
	27. Consumers*	
	28. Import	
	29. Export*	

* Included in order to specify the location of consumer and export demand.

each of the modes.[4] For each of the submodes individual calibration allowed cross checks to be made on operating costs. Data on Colombian factor prices for use in the calibration process were obtained from a number of sources.[5] Commodity distribution models were checked against the Gilmore flows for each of the subcommodities. Flows were also reviewed for reasonableness, commodity by commodity. Final calibration of the entire model was checked for the period 1956 to 1966 by comparing actual time series figures for consumption, investment, imports, exports and GNP with figures generated by the model and by comparing transport flows on the model network with observed real world flows.[6] Flows from the model were compared with results from an engineering survey.[7] The survey flows include some urban traffic as well as intercity flows which tended to swell the volume near major urban areas. After allowing for this difference, it appeared that the flows generated by the model approximated those in the real world rather closely.

Unfortunately, calibration is at present more an art than a science. It involves a feel for which variables one should adjust to bring a generated series into line with its real world equivalent and which data one should suspect or even reject as unreliable. The nature of the process makes it impossible to state with certainty that the calibrated model precisely reproduces real world behavior. But careful calibration will

[4] See Enrique Ordonez, *Aspectos Diversos Del Transport en Colombia* (Banco De La Republica, Bogota, Colombia). Jan de Weille, *Quantification of Road User Savings*, International Bank for Reconstruction and Development, International Development Association, Dec., 1965. Madigan Hyland South American Corp., *Completion of Atlantic Railroad and Review of Financial Problems*, Mar., 1959. Colpuertos, *Empresa Puertos De Colombia, Boletin Informativo*, published intermittently.

[5] *Analysis and Projections of Economic Development, the Economic Development of Colombia* (United Nations Economic Commission for Latin America, Geneva, 1957). International Bank for Reconstruction and Development, *An Appraisal of the Development Program of Colombia*.

[6] Time series data for GNP, investment, consumption and foreign trade balance were available from D.A.N.E., the Colombian Statistical Agency, for the period 1956 to 1966.

[7] Parsons, Brinkerhoff, Quade and Douglas, *Plan for Improvements in National Transportation* (Ministry of Public Works, Republic of Colombia, Dec., 1961).
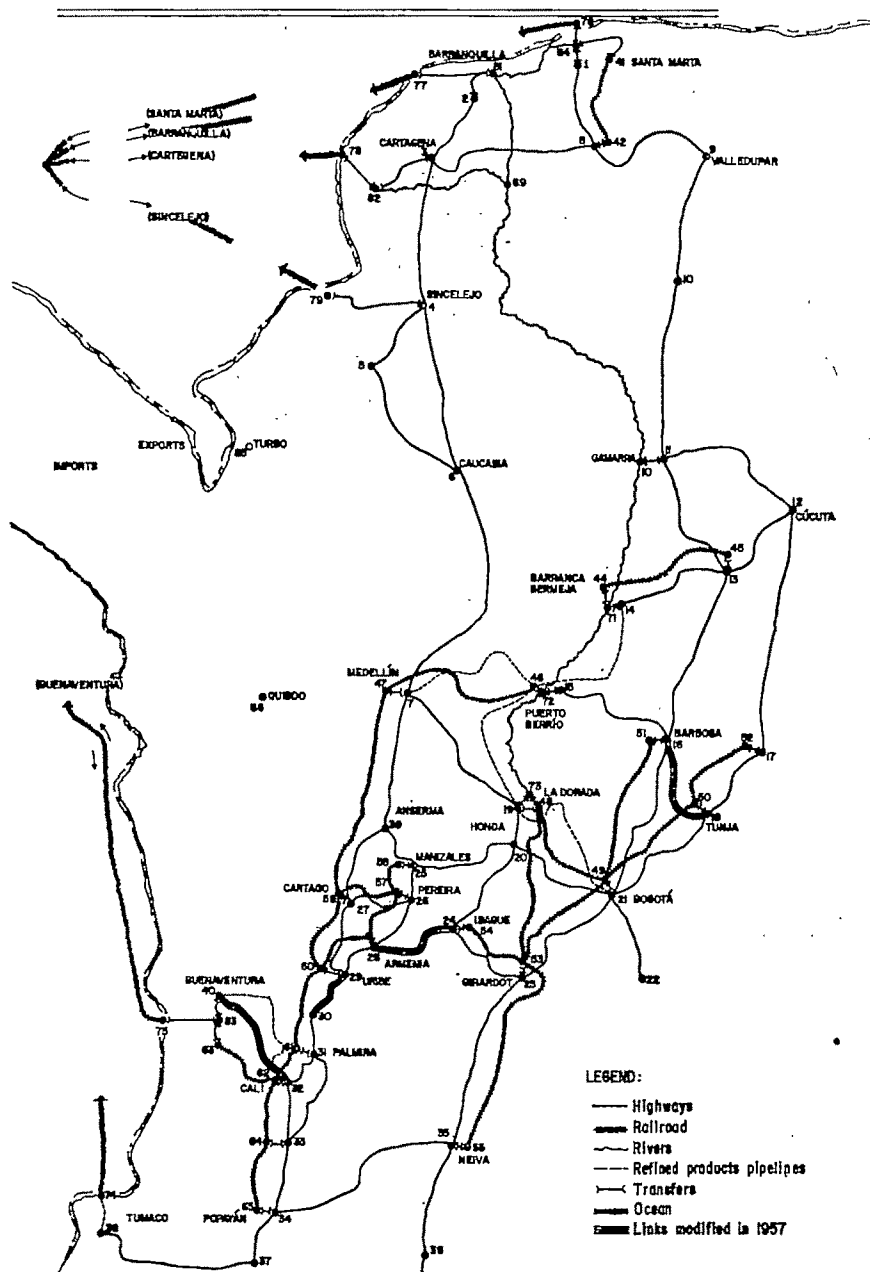
FIGURE 5
SIMULATED TRANSPORT NETWORK COLOMBIA 1956

reduce the margin for error to more tolerable limits. Based on the calibration results, the final model was judged to replicate the Colombian economy and transport system satisfactorily for present purposes. That is, it seems sufficiently accurate to be used for a series of experiments designed to illuminate the role of transport in the development process and to draw general conclusions about the operation of the transport system and its modal subparts. However, the model should not be used in its present state of calibration for particular policy recommendations or for the planning of specific new investments in the transport system since a number of important problems still remain. A principal omission is the lack of an absolute import restriction; this allows the model of the economy to grow somewhat faster than did the real world. The calibration of a model which corrects these difficulties for use in specific policy recommendations is now nearly completed.

Experiments with the Model

In using the model to determine the role of transportation in economic development, the approach will be to employ the model as a laboratory device upon which experiments are performed. By keeping the questions relative rather than absolute, the deleterious effects of imperfect calibration are minimized. Situations can be compared, first with and then without a certain feature of the transport network. The differences which result are considered to be the effect of including that feature within the plan.

There are, of course, a wide range of public transport policies which will affect investment, consumption, or foreign trade balance. However, direct government investments and taxation are not of interest here since they represent more or less standard techniques of fiscal policy. An elaborate transport model, such as that involved here, is certainly not needed to answer general questions of fiscal policy. Therefore, the present experiments were designed to eliminate differential direct government investment from the analysis so that it would not obscure differences attributable directly to the specific nature of the transport program.

Changes in economic activity induced by changes in the transport system are the effects of most interest for general transportation planning. These changes typically begin with a cost reduction in the transport sector. Cost reductions come about as the result of changes in the technology employed or as the direct consequence of changes in transport network topology or link characteristics. Tracing the effects of a network change through to the resulting change in GNP is a complex but not impossible task. (See Figure 6.)

Network improvements result initially in savings of travel time and
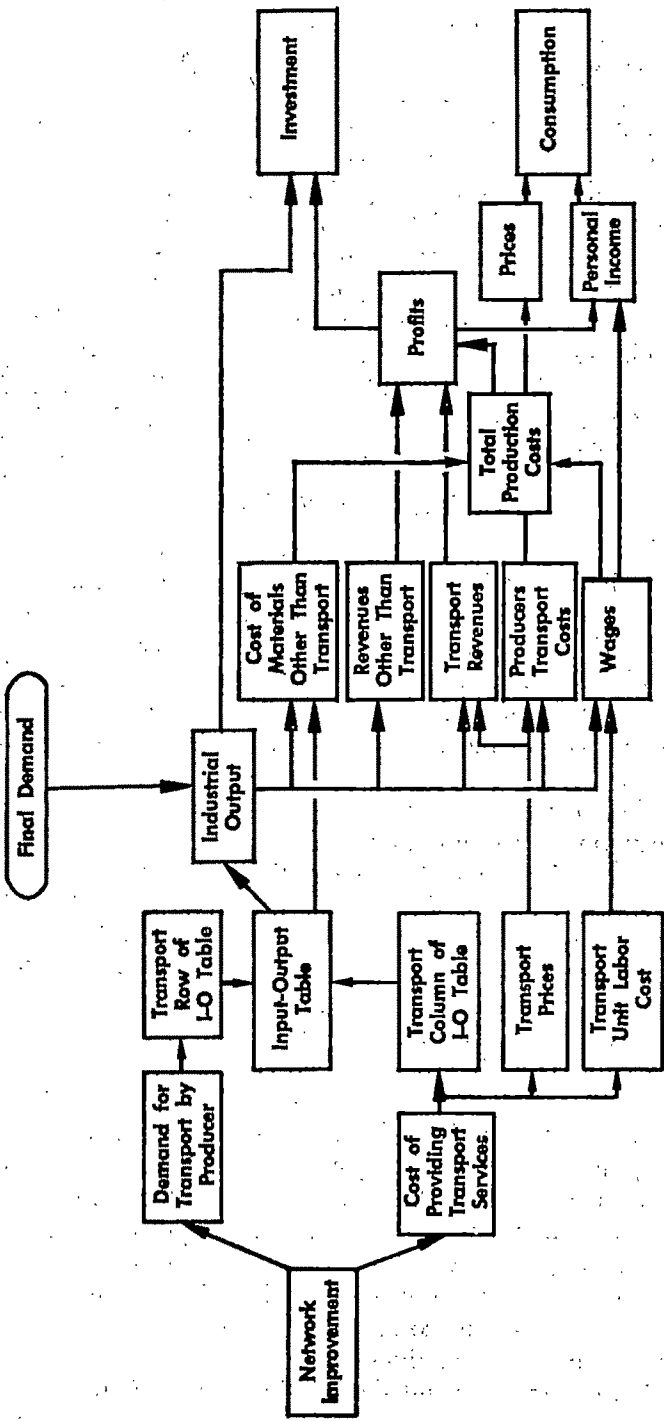
FIGURE 6

THE MANNER IN WHICH NETWORK CHANGES CAN BE TRACED THROUGH THE ECONOMY

fuel, reduction in wear on the vehicle, lowered probability of shipment loss, and so forth. Physical changes in the network also tend to alter the production requirements of the transport industry. Within the model, these changes correspond to changes in the technological coefficients of the input-output table, and in particular to changes in the transport column. As another effect of the improvements in the transport network, shippers may find it profitable to use more transport. In this event there will also be a change in the transport row of the input-output table. This assumes, of course, that at least some of the benefits of the improvements are in fact passed on to the shippers rather than being retained by transporters in the form of increased profits.

Under most circumstances, these changes in production methods will produce changes in both prices and incomes. Consumption will then be adjusted to the change in personal income and to the new set of prices. If prices fall, real consumption can rise even without an increase in personal income. The changes in prices and hence in profits may also induce a change in capital investment. These changes in consumption and investment will then generate changes in output which will in turn affect wages, costs, profits, and prices in the new year. Thus, transport improvements will have touched off a response in the economy which continues from year to year over a rather long period. The result is also likely to be multiplicative as opposed to merely additive.

Clearly the net effect of this process would be extremely difficult to follow without the use of some formal model such as that employed here. To isolate the impact of a specified change in the transport network, two experiments must be performed: one in which the change is made and another in which it is not. The second experiment provides a base from which to measure the impact of the changes. Since this procedure screens out all other sources of discrepancy, any differences between the two experiments can be attributed to the transport improvements.

In the results reported here, the base run, which will be referred to as NULL, uses the unaltered 1956 transport network. The set of experimental changes, labeled EXPER1, involves making improvements over time to a number of highway links. The changes made in EXPER1 during year two are shown on the map of Figure 7. They consist of improvements to five roads (four of which are on the main route from Bogota to the port of Buenaventura).

Changes made to the transport network in the second year will have no effect on GNP until the third year because of the lagged nature of the model. In the third year, however, GNP is higher in the improved scheme by 7.8 million pesos. The changes also resulted in an overall
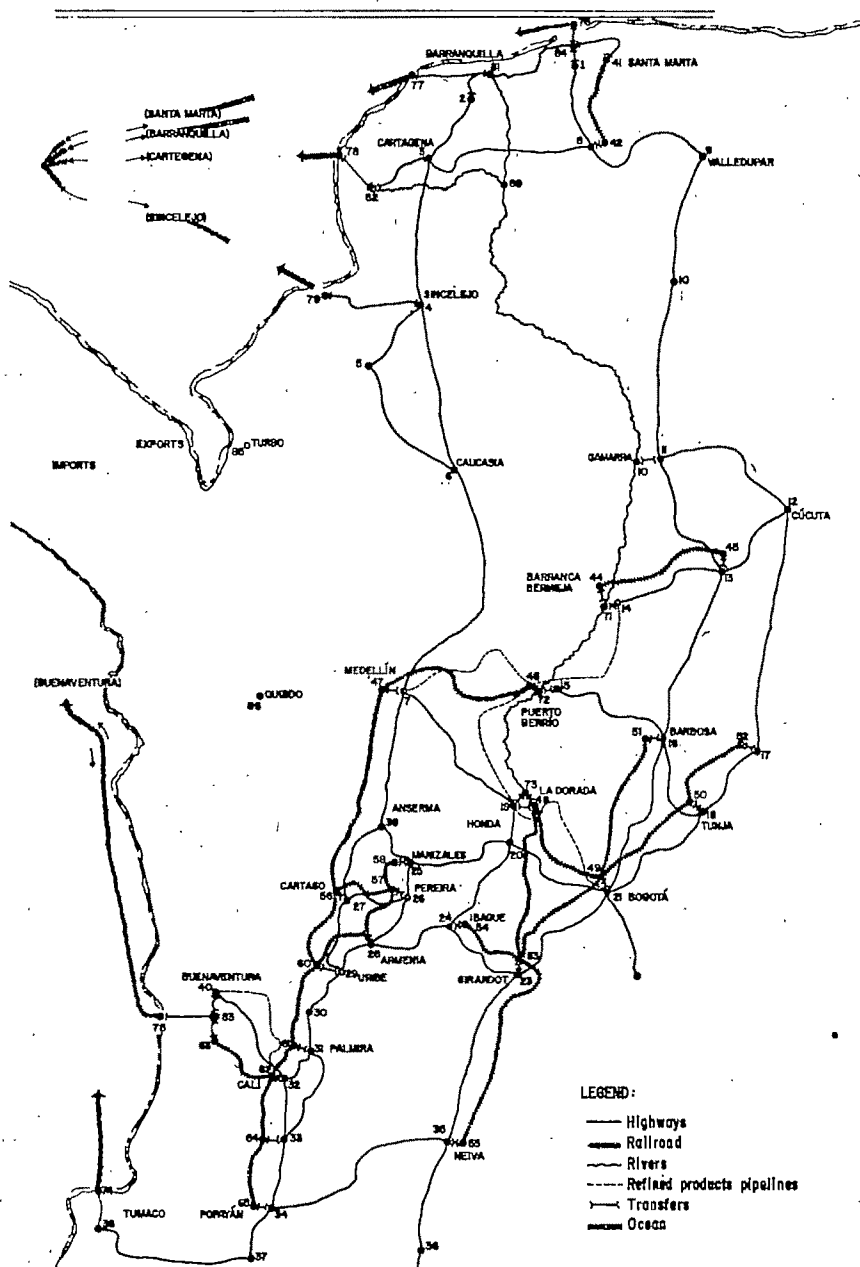
FIGURE 7
SIMULATED TRANSPORT NETWORK COLOMBIA 1957

TABLE 2

SUMMARY OF THE EFFECTS ON GNP IN YEAR THREE OF A SET OF
TRANSPORT IMPROVEMENTS IN YEAR TWO

Difference Between EXPER1 and NULL
(Millions of Pesos)

GNP	+7.8	
Consumption	+8.9	
Contribution to consumption of:		
Wages and distributed earnings		− 2.8
Prices		+11.7
Investment	− .3	
Imports required for production	− .8	

decrease of approximately 5.5 percent in direct operating costs to the transporter for providing transport service.

It is interesting to examine the cost savings more closely. The decrease in costs to transporters is only part of the relevant savings. In addition there are transport time savings, improvements in schedule frequency, and reduction of loss and damage. These savings are measured in the model by the R-Factors. R-Factors represent the sum of all costs, both tangible and intangible, encountered by a particular commodity moving along the minimum path between origin and destination. Since they are a measure of the willingness of a shipper to pay for an increase in level of service by changing mode or routing, they are also a measure of the value to the economy of saving time, etc.

In the experiment described above, R-Factors savings amounted to 18.7 million pesos per year. This was a 2.3 percent savings over the NULL plan. The greater savings percentage-wise to the transporter than to shippers or travelers is due to the fact that the improvements were principally paving which tended to reduce costs more than they decreased time. The R-Factor savings were also accomplished in the face of a .3 percent increase in the amount of shipping and therefore of potential congestion. The net effect was to reduce R-Factor costs per unit of output by 2.6 percent.

Transport costs overall were down largely due to the reduction in transport wages. For the economy as a whole, wages declined by 6.7 million pesos. Distributed earnings were up by 3.6, however, so that wages plus distributed earnings were down by only 29 millions of pesos. Prices fell in response to the decrease in transport costs experienced by most industries. The result was an increase in buying power equivalent to 11.7 million pesos. Since the decline in prices more than offset the reduction in personal income, the net effect on real consumption was an increase of 8.9 million pesos.

The effects on GNP in year three of the year two improvements are summarized in Table 2. The composition of GNP has changed toward

TABLE 3

DIFFERENCES IN R-FACTORS AND GNP BETWEEN EXPER1 AND NULL
(Millions of Pesos)

Year	RFAC Savings	GNP Increases
1	0	0
2	18.7	0
3	53.0	7.8
4	72.0	29.0
5	86.0	47.0
6	198.0	93.0
7	23.0	107.0
8	139.0	169.0
9	179.0	242.0
10		263.0
Total	768.7	957.8

more consumption. Investment and imports required for production are down slightly while consumption and GNP are up. The most important single effect to GNP in this situation is the contribution made by prices since in this case wages and earnings actually went down.

It is more difficult to follow the effects on the economy during the next year of a second round of changes made during the third year. From year to year the effect is cumulative, however, and GNP continues to grow faster in the improved plan than in the unimproved version. By year four the difference in GNP has increased to 2.9 million pesos and by year five it has grown to 47 million pesos. The differences for an entire ten years are shown in Table 3. Note that savings in one year do not affect GNP until the following year so the series are offset. The offset has been removed in the plot of Figure 8 in which both R-Factor savings and difference in GNP are shown simultaneously. It is clear that over the long run differences in GNP are growing faster than those in cost savings, since differences in GNP overtake R-Factor differences by the sixth year and remain higher thereafter.

It is useful to examine the extent to which cost changes in the transport system are reflected to GNP increases. It is clear from Figure 8 that cost savings take some time to work through to GNP increases but that the eventual magnitude of the GNP increase is larger than that accounted for strictly by cost savings.

Conclusions

Use of the model for experiments such as the one described above has led to a number of conclusions. The most important one is that the model is extremely useful from an analytical and pedagogical standpoint. A great deal may be learned about system behavior and in par-
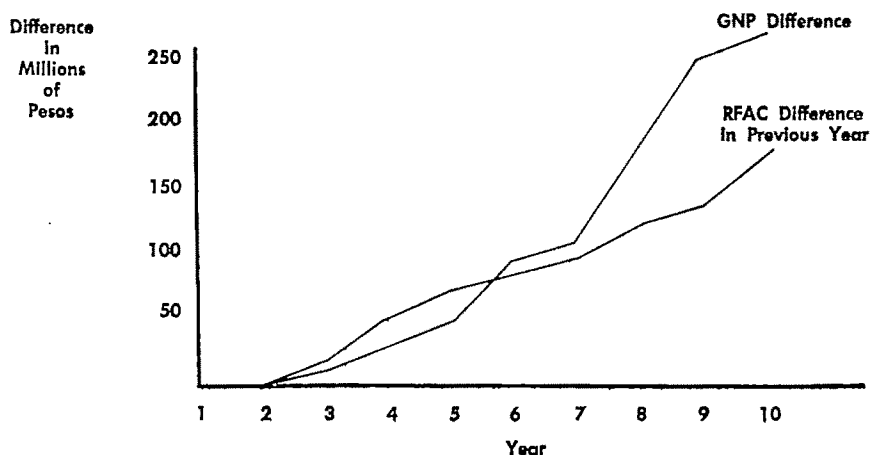
FIGURE 8
GNP AND R-FACTOR DIFFERENCES PLOTTED TOGETHER

ticular about the relative importance of various aspects of the system and their interrelationships.

A second major conclusion is that for large systems it is difficult to make system changes that lead to cost savings of more than 20 to 25 percent over a ten-year period. At the same time, it is unusual for transportation to account for more than about 10 percent of total output. This means that cost savings as a percent of total output may be fairly small, on the order of 1 to 2 percent. Although this is not much in percentage terms, it may amount to quite a bit in absolute terms. It may for example be 200 to 300 percent of the annual transport investment in new facilities. The growth in GNP which occurs as the result of the transport investment cost savings alone may in fact be quite large. From the standpoint of the transport planner, therefore, the exercise should have a great deal of relevance.

A DEVELOPMENT MODEL OF TRANSPORT

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I. *Introduction*

The effect of investment in transport facilities on development has been the subject of many investigations.[1] New or improved transport arrangements open up the country and enable the exploitation of hitherto untapped or underutilized natural resources. The effects of lowering the cost of transport can (in principle, at least) be traced through the product and factor markets, and so one may calculate the benefits of the investment and compare them with the costs. But, of course, such calculations may be extremely lengthy and complicated, and obviously the more effects one decides to trace, the more information one needs on elasticities of response in factor and product markets. In principle, one may even embed a transport investment project into a macroeconomic model; indeed, if the project is so large relative to the resources of the country, it may well be that a macroeconomic, multisector model will serve the planner better than one of the traditional partial or sector models.

One of the best examples of the macroeconomic approach to transport planning is the Harvard model for Colombia. In this model the transport sector is related, through a system of equations, to all other sectors of the economy. This enables one to optimize transport investment between modes and sectors. The Harvard model is the most "complete" model for making transport decisions. Unfortunately, like most intersectoral models it requires a lot of data to put it to work; the "output" of the model is impressive, but the "inputs" required are not small. Nevertheless, models of this broad category must eventually be used for macroplanning, and it is important that we obtain some knowledge of how they work in practice.   •

At present much of the practical work in transport is concerned with the analysis of small projects—with seeing whether or not a particular road is a good investment, or with examining whether one should improve a railroad. It is hoped that the project is so small—relative to the national economy—that the effects of the improvement can be isolated both regionally and within a handful of industries. Then one need

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[1] Recent research has suggested that transport followed rather than generated development. See Robert W. Fogel, "A Quantitative Approach to the Study of American Economic Growth," *J. of Econ. Hist.*, June, 1962, and Paul Cootner, "The Role of the Railroads in United States Economic Growth," *J. of Econ. Hist.*, Dec., 1963. The authors suggest that the role of transport in the process of growth has been much overstated.

not pursue investigations of the "small" effects on other sectors.[2] The effects of the transport investment can then be predicted from the small amount of information needed for the relevant areas and sectors.

Since such project analysis is the basis upon which many investment decisions are made, the model that lies behind such calculations is of some importance. But the striking feature of the verbal descriptions of the analysis is the enormous complexity. One suspects that much of this complication is a reaction to the highway engineer's traditional rule of thumb—such as "pave the road when average daily traffic volume exceeds 100 vehicles." The economic analysis of projects does take into account new traffic generated by the improvement and does attempt to evaluate how much the new traffic is worth.[3] But the complexity of the approach does limit its range of application. Such an expensive method of project appraisal is simply not worthwhile for a wide variety of rural roads, for example. What is required is some model that provides a rule of thumb similar to that of the engineers but that does take into account the development effects of transport investments.

In this paper I suggest a model that may be considered as a possible candidate for this role. The model was developed originally for the analysis of the effect of different methods of charging for the use of the highways. I was mainly interested in the quantitative effects of various forms of motor taxation, and consequently the basic account of this model reflects this preoccupation.[4] But it has been obvious from the beginning of the research that the model could also serve as a (partial) development model for transport investment—and in particular road investment. The strength—and the weakness—of the model is its simplicity. Very little information is required in order to put the model to work. But by the same token, much is ignored.

The acid test of any model is whether it works well in practice— whether it is an improvement on other models of a similar cost, and whether alternative models provide such valuable additional information that they are worth additional cost. Although some attempt is made in this paper to check the conclusions of our simple model against such facts as one could trace, there has been no comparative analysis made with other theories.

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[2] Although this is a standard rationalization of the partial approach, it is worrying to have to ignore small effects—because, clearly, if there are a sufficiently large number of small effects which do not cancel one another the aggregate effect may be large.

[3] For an account of some *ex post* assessments of projects, see George W. Wilson, *The Impact of Highway Investment on Development* (Brookings Institution, 1966). For an account of an *ex ante* and *ex post* assessment of some road projects in Iran, see Jan de Weille and H. G. van der Tak, *Economic Reappraisal of a Road Project: the First Iranian Road Loan of 1959* (I.B.R.D., 1966).

[4] See my monograph, *The Economics of Road User Charges* (I.B.R.D., forthcoming) (Johns Hopkins, 1968).
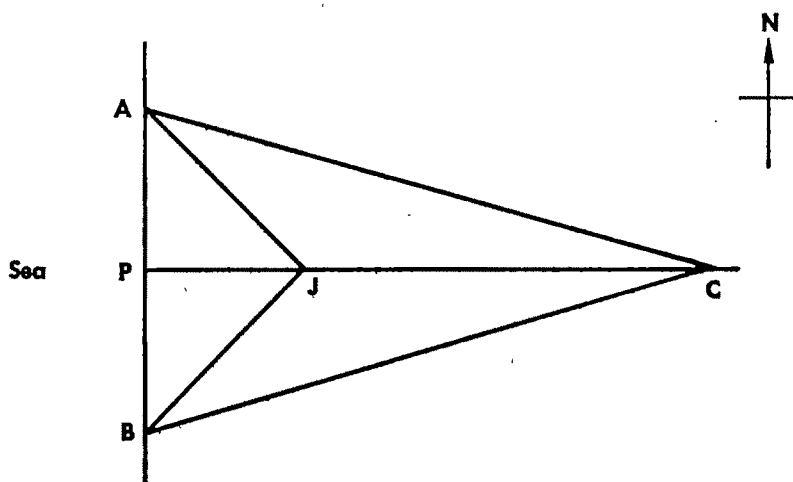
The "Endless" Road
(a Plan)

FIGURE 1

II. *The Model*[5]

Consider a country which consists of homogeneous land with no natural transport arteries but with ports which lie at various intervals along a straight coast. Consider one such port at P in Figure 1, and let us suppose that, at this port, there is an infinitely elastic demand for some commodity (e.g., rubber) which may be produced by the (homogeneous) land. Thus farmers may sell as much as they like at the port at the ruling price. Let us assume that the price is $\$k$ per ton and that the productivity of land is constant at one ton per acre.

Now let us examine the "before" and "after" situations when a road is built, at right angles to the coast, into the interior. Rules of transport are required. We here adopt the stringent hypothesis that transport can take place in a direction either parallel to or at right angles to the coast. (If we imagine the coast running north-south, it follows that transport can take place only on a north-south and east-west lattice.)[6] Before the road was constructed there was only transport by foot—let us call it "headloading"—which was done at a constant cost of $\$b$

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[5] A more complete description of the model and the generalizations is to be found in my manuscript for the I.B.R.D. (see above).

[6] Although this seems to be a crucial and cramping constriction on the model, one finds that in practical applications to road investment, it does not matter very much. But of course one needs to beware of those cases where it does matter—such as when road transport supersedes another form of transport which is not very costly. See I.B.R.D. manuscript for some calculations.

per ton-mile. After the road is constructed transport is available along the road at a per ton-mile.

Let us suppose that the next port to P is a long way away. Now we can construct the area of cultivation on the assumption that there is only one crop (and that otherwise the land would lie fallow) and after making suitable assumptions about the costs of inputs of other factors of production. It is simplest to assume that the cost of the input required per unit of output is constant—a fixed (money) input coefficient. Let us therefore denote the cost of the inputs, other than land, required per unit (ton) of output by $f. We describe the location of an acre of land in terms of its x, y coordinates—where, with P as the origin, we measure x as the nonnegative distance east of P, and y as the (positive or negative) distance north or south of P.

Before the road is constructed, the area of cultivation is described by the conditions:

$$b(x + y) \leq k - f \qquad y > 0$$
$$b(x - y) \leq k - f \qquad y < 0$$

(We note that the second condition is a mirror image of the first; usually we shall merely write the first equation, leaving the second mirror image to be understood.) Thus we can write the rent of an acre of land described by the x,y coordinates as:

$$k - f - b(x + y) \qquad y > 0$$

If this is nonnegative, the land will be cultivated. Thus in Figure 1 the area is described by the triangle ABJ.

After the road is constructed, the area of cultivation is determined by the conditions:

$$ax + by \leq k - f \qquad y > 0$$
$$ax - by \leq k - f \qquad y < 0$$

Thus development has been pulled out along the road so that the area of cultivation is now described by the triangle ABC.

The reader will observe that we have assumed that there is an "endless" road of homogeneous quality.[7] A word or two of defense is in order at this stage. Clearly if the government built roads with only "development" objectives in mind, it should take into account that, with a homogeneous road standard, it would pay to stop the construction of the road before it reached point C. (Indeed, later in this paper we

[7] The assumptions can be reduced to less stringent, but less evocative, terms. See I.B.R.D. manuscript for details.

shall indicate what the stopping rule should be.) But an analysis of the endless road case can be justified, first, on the grounds that it is much simpler to deal with than the truncated highway and, second, agricultural development may not be the overriding reason for building the highway; it may be required to connect two towns for military or administrative purposes. In fact the endless road case is interesting precisely because one encounters many practical examples of this kind.

It is more difficult to defend the assumption of a road of homogeneous quality. Since traffic will be more dense the nearer one gets to the port, it is sensible to construct a better road near the coast and, if it is technically feasible, to gradually let the standard of the road deteriorate as one penetrates the interior.[8] In practical cases one does frequently find that the highway degenerates either gradually or in steps as one gets further from the coast. It will be observed, however, that our assumption strictly relates to the ton-mile cost of transport along the highway. Obviously, traffic from the interior travels greater distances than traffic originating near to the coast. Since there is a "taper" in transport cost per ton-mile according to the distance carried, the consignments from the distant interior would be carried at a cheaper rate per ton-mile if the road conditions were homogeneous. But if the road does get worse inland, then the cost of the long journey would be raised. Thus these two tendencies would offset one another to some extent; the assumption of a constant cost per ton-mile may therefore be quite a useful practical approximation.[9]

Let us now return to the model. One obvious task is to calculate the rent surface with and without the road (Figure 2). Before the road was constructed, it is clear that the farm at P earned the maximum rent of $(k-f)$, or we can define $k^*(=k-f)$ as the price per ton of output less the factor costs required to produce it. At A, B and J the rent is clearly zero. The rent surface is therefore a pyramid erected on a triangular base ABJ with a maximum height of k^* at P, and with a vertical side next to the seacoast.[10]

To calculate the rent surface after the road has been constructed, one may observe that the maximum rent k^* is still unchanged at P. Now, however, the locus of zero rents is described by the lines AC and BC instead of AJ and BJ. The effect is then to stretch out the rent pyramid along the road—its shape remains otherwise the same as before.

We can now construct a benefits-from-the-road surface. Since all benefits appear in the form of rents, one simply finds the difference

[8] We suppose that there is no congestion, even near the port.
[9] Some calculations show that this wishful hoping cannot be carried too far. See I.B.R.D. monograph.
[10] Of course, pyramids are normally erected on a rectangular base—but it is convenient to use this familiar term to describe a similar figure with a triangular base.
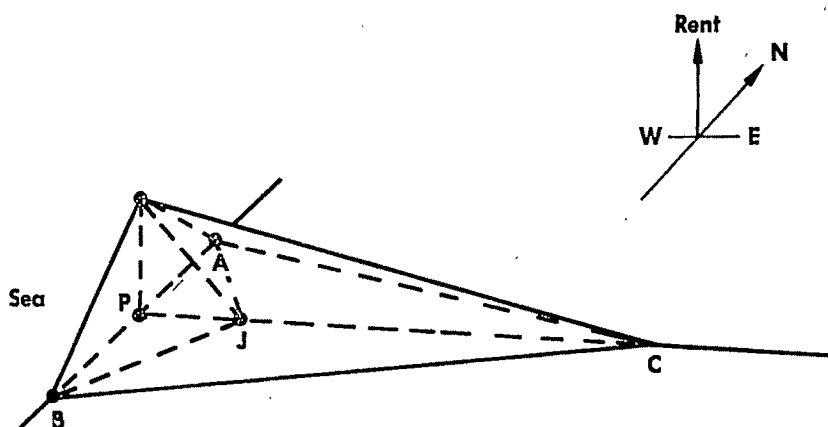
The Rent Pyramid

FIGURE 2

between the the two rent pyramids. The benefit pyramid has a maximum at J. The farm at J benefits most from the construction of the highway and its rent per acre is increased from zero to the difference in transport cost by road and by headloading from J to the port. The distance PJ is clearly k^*/b, and the benefit accruing to the farmer at J is therefore: $k^*(b-a)/b$. This is the maximum height of the benefit pyramid. The benefit pyramid extends a distance of k^*/a along the highway. And we can find iso-benefit triangles by finding the reflection of the cut through the benefit pyramid at some fixed benefit height. Such iso-benefit triangles are similar to ABC and converge to a point at J, where the benefits are $k^*(b-a)/b$.

It is easy to calculate the area of cultivation and total rents of land before the construction of the highway. The area of cultivation (in acres) and so the quantity of output (in tons) is:

$$(k^*/b)^2$$

and the total rents before the road is constructed are:

$$k^{*3}/3b^2$$

The tonnage carried by headloading is of course $(k^*/b)^2$.

After the road is constructed the area of cultivation increases to:

$$k^{*2}/ab$$

and the total rents increase to:

$$k^{*3}/3ab$$

Now we can also find the ton-mileage of traffic along the road. This is given by:

$$k^{*3}/3a^2b$$

We could also caluclate the ton-mileage by headloader, and the distribution between headloading and motor carriage—but we do not need these results for the purposes in hand.

One of the interesting problems of road development is to calculate the elasticity of demand for traffic on the highway. A variety of names are used for this concept—such as development traffic, generated traffic, induced traffic, and so on. We can see immediately from the formulation that there are two elasticities of interest: the elasticity of demand for the road in terms of tons carried and the elasticity of demand in terms of the ton-mileage carried. Both of these concepts are measured with respect to variations in the cost per ton-mile by road.

Using epsilon to denote the elasticity of demand, we can write down the result directly as:

$$\epsilon_{tons} = -1$$

$$\epsilon_{ton-miles} = -2$$

Thus a 10 percent fall in the ton-mile cost of motor transport will give rise to a 10 percent increase in the tonnage transported over the road and a 20 percent increase in the ton-mileage of the motor transport industry. A fall in road transport cost stimulates exploitation of the interior, and so the average length of haul is increased.

These are exceedingly simple results—and easy ones to remember— so it is useful to emphasize the assumptions on which they have been derived.[11] Apart from the suppositions of an endless road and homogeneity of transport cost throughout the whole length of the road, we have also made the crucial assumption that the demand for the commodity is infinitely elastic at the port P. This means that we can ignore many complications—one of the main ones being that the fraction of the final price that goes to reimburse the providers of transport simply does not matter. The fraction attributable to transport cost may be 1 percent or 99 percent. It in no way affects the elasticities. We simply "net out" the cost of other factors and proceed with the simple model. Second, we have assumed that there is no traffic other than the commodity produced by agriculture. In practice, one would expect that there would be other traffic. In particular, goods would be imported from the coast and consumed by farmers in the interior. Introducing return traffic, however, is unlikely to affect the elasticities. Imports are likely to move proportionately to outputs, but the goods imported

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[11] But, of course, I would argue that the model stands or falls according to the accuracy of its predictions.

are most probably of a lower bulk, and so the marginal cost of transport inwards would be near zero. Consequently, we feel that imported traffic may be safely ignored. Third, we have taken no account of the costs of picking up a consignment, and effectively we have supposed that (different) vehicles stop at an infinite number of pick-up points along the highway. In practice, however, one would expect a concentration of consignments at pick-up points—the number of which would depend on the relative costs of headloading and motor transport running costs and the costs of a pick-up. Again, however, it is doubtful whether such an elaboration would affect the elasticities.

The major assumption which we might question at this stage is that of infinite elasticity of demand for the product at the port P. It is worth emphasizing, however, that this is not a stringent assumption. For many commodities produced by agricultural sectors in developing countries, one may take it that the supply of the country as a whole to the world market is small enough so that the effect on price may be ignored. Consequently, the additional contribution to supply caused by the improvement of a particular road may clearly have no effect on price.

But one would like to use the model for cases where the country supplies a domestic market at P—for example when P is an urban area and draws food from the interior. Clearly, the elasticity of demand for food in the urban area is unlikely to be perfectly elastic; as more acreage is opened up the quantity put onto the market would increase and so the price would fall.[12] Thus k is a diminishing function of the area of cultivation. The effect can be represented graphically by the triangle $A'B'C'$ where the old triangle ABC represents the area of cultivation when there was no change in price (Figure 3). The boundary $A'C'$ is parallel to AC since there has been no change in the relationship between headloading and motor costs of transport; but the distance of cultivation along the coast and the depth of penetration into the interior have been proportionately reduced—by let us call it a factor ψ, which depends on the elasticity of demand and the fraction of total cost attributable to transport. One extreme case can be disposed of immediately: this is, where the demand for the commodity is perfectly inelastic. Then of course the "shrinkage factor" ψ is determined by the condition that the area of cultivation must always be the same. The building of a road only results in a relocation of cultivation along the road.

[12] It is worth noting, however, that the price of food may be fixed by the import cost (and this may be the import cost by sea rather than from other areas in the country), so that, even in this case the availability of alternative supplies at a fixed price may in fact give the equivalent of an infinitely elastic demand for food from the interior—up to the point where all the demand is satisfied by food coming down the road. After that point, of course, price will decline as the quantity increases.
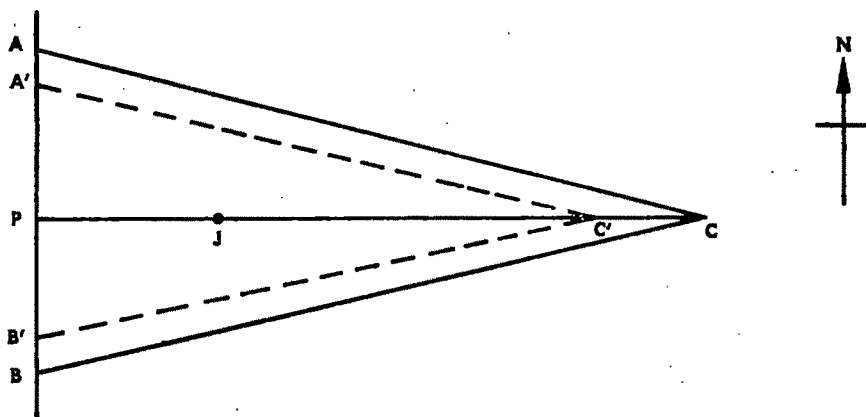
The Area with Finite Elasticity

FIGURE 3

It is worth noting that it is also possible to deal with another facet of reality while we are introducing downward sloping demand curves; since $k^* = k - f$ it is clear that a decrease in k is similar to an increase in f. Thus one might suggest that, while using the model to deal with a finite elasticity of demand for the output, one could also easily take into account increases in factor cost due to the limitation of the supply of factors of production. They both have symmetrical numerical effects.[18] On the one hand, k varies negatively with the area of cultivation, and on the other hand, f varies positively with the area or output. Thus with an upward sloping supply curve for factors of production in agriculture, one would find that factor scarcity reinforces the effects due to the inelasticity of demand for the output. Alternatively, if there is a falling supply curve for factors of production, changing factor prices would to some extent offset the fall in product price as the area of production expands.

Obviously it is convenient in practice to work with the net transport price k^*. One can then discuss the elasticity of demand with respect to the net transport price, which we may define as the net elasticity:

$$\eta^* = \frac{k^*}{A} \frac{dA}{dk^*} = \frac{k - f}{A} \frac{dA}{dk - df}$$

And this may be expressed in terms of the constituent elementary elasticities.[14] One of the interesting problems is to calculate the effect on the elasticity of demand for road transport for a given net elasticity η^* of demand. It can be shown that the elasticity of demand for trans-

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[18] The economic effects, however, may be quite different.
[14] See appendix for some details.
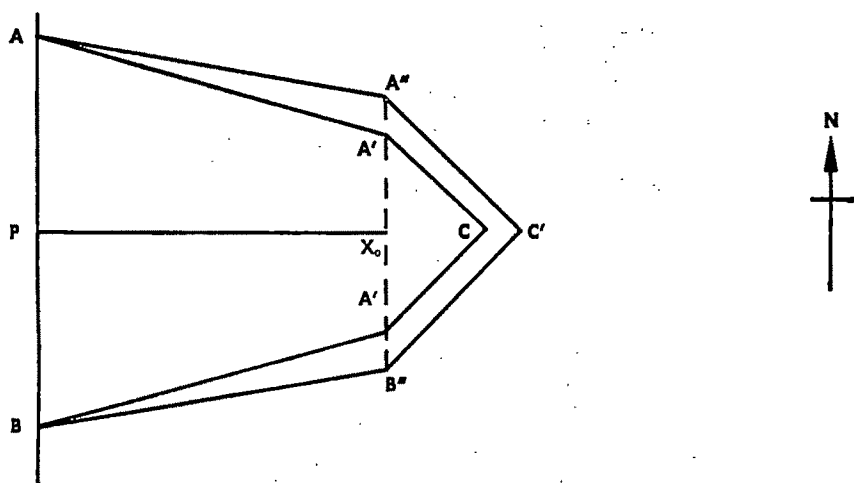
The Area with a Truncated Road

FIGURE 4

port in our simple endless road model (using a tonnage measure of quantity) is given by the formula:

$$\epsilon_{tons} = \frac{\eta^*}{2 - \eta^*}$$

This again is a simple result—although of course slightly more complicated than the case of infinitely elastic demands. We can check that as η^* approaches very large negative values, the elasticity of demand for transport approaches (minus) unity. Similarly as η^* approaches zero, so the elasticity of demand for transport approaches zero.[15]

The results of this excursion into the problems of finite elasticities suggests that, in practice, it is relatively easy to allow for the complications. But this depends on having knowledge of slopes of the demand curve for the commodity and of the supply curve of other factors.

We might now briefly consider the complications introduced by the fact that a road is truncated rather than endless.[16] But we continue to assume that the surface and width of the road is homogeneous—which perhaps may be rationalized in terms of the technological conditions. The area of cultivation is then illustrated in Figure 4 by the area $AA'CB'B$. Now we may consider two changes in road conditions: an

[15] It is easy to see that in this latter case the elasticity of demand for transport (in terms of ton-miles as the quantity measure) is −1. Cultivation is distributed further into the interior and clusters around the road so that the ton-mileage increases but the tonnage remains the same.

[16] A more extensive account of the truncated road case is to be found in the I.B.R.D. manuscript.

improvement in the quality of the existing length of highway, or an increase in the length of the present quality of road. We examine first the consequences of improving the quality of an existing length of highway. The effect can be seen to be an expansion of the area of cultivation to $AA''C'B''B$. The "end of the road" triangle expands in each dimension (except the coastal side) proportionately to the reduction in motor transport cost for the entire length of road. It is clear that the elasticities of demand for transport, as the quality but not the length of the truncated road increases, will be somewhat less than on a comparable improvement on the endless road. Unfortunately, there is no simple formula to express this result.[17] A few calculations suggest that realistic values of the elasticity for the truncated roads would likely exceed 0.5 and probably would be in the region of 0.7.[18] More or less the same sort of damping of elasticities takes place when we consider the demand elasticity with ton-miles as the measure of quantity; instead of -2 the elasticities are of the order of 1.5. These calculations suggest that the elasticities are reduced somewhat—but not to trivial levels—when one considers the improvement of a truncated road.

The second problem is to examine the consequences of investment in lengthening the road. Geographically one would observe simply an expansion of cultivation in the form of a chevron-shaped area from outwards to the east—as illustrated in Figure 5. The limits of cultivation for the old length of road would remain exactly as before. A small increment in the length of the road (say from x_0 to $x_0+\Delta x_0$) will give rise to an increase in the area of cultivation of:

$$2(1 - a)(k - ax_0) \cdot \Delta x_0$$

(where we have standardized $b=1$).[19] And the benefits of extending the highway by Δx_0 are measured by the volume of the rent pyramid over this new section. The total benefits are given by:

$$\Delta x_0(1 - a)(k - x_0)^2$$

These are the rents reckoned in terms of the standardized unit $b \doteq 1$. And if we assess the costs of constructing Δx_0 additional road (in terms

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[17] If the length of the road is d, the elasticity of demand with respect to the ton-mile cost is:

$$e_{tons} = \frac{- ad[db + 2(k^* - ad)]}{db(2k^* - ad) - (k^* - ad)^2}$$

One can check that for $d = k^*/a$ the elasticity is minus unity, and the result is the same as for the endless road. The calculation of the ton-mile elasticity is even more complicated.

[18] This supposes that (ad/k) is not less than about 0.55. If the road were very short, then it seems that the case for lengthening it would be so strong that there would be no case for improving merely the existing length. But in practice this depends on the relative costs of improving and lengthening the highway.

[19] See appendix for proof.
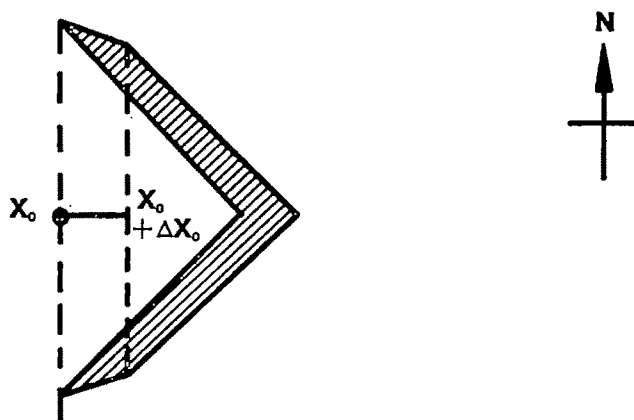
The Effects of an Increase in Road Length

FIGURE 5

of the standardized unit), we may compare this cost with the benefits generated by such a small road extension. Thus we have an investment test which is expressed in terms of the cost of headloading, of motor carriage and the price of output at the port (and of course the existing length of highway).[20] This completes our examination of the truncated road.

This naturally leads one to enquire into the detailed analysis of benefits from the building of highways and the effect of various tax structures on the use of the roads, the area of cultivation, and the benefits that the community derives from the building and taxation of the highways. These problems will be discussed elsewhere and we shall not pursue this aspect of the analysis in any detail here. It is, however, worthwhile noting that this model is particularly useful for the analysis of the benefits and the effects of different tax structures on benefits. The simplicity arises from the fact that the benefit pyramid has similar cross-sections in the direction of lines parallel to the road. Thus it is possible to analyze merely one cross-section—on a two dimensional graph—and the results can then easily be extended to the area as a whole. From this analysis of the benefits and taxation, several general results emerge—two of which are of interest here. First, it is easy to discredit the hoary old principle, "those who use the road most get most benefit from it." Clearly they don't. Second, and I think of more interest, we can show that the typical motor taxes which have an incidence

[20] This investment test, however, is only in terms of development effects.

on the ton-mile or vehicle-mile are inferior, and probably much inferior, to alternative types of feasible taxes such as market and export taxes.

This completes the brief outline of the basic model. The reader will readily see that it is easy to elaborate the simple model to deal with more complicated situations. For example, if there are a number of possible crops which might be grown, we can describe the boundaries of cultivation in terms of the transport costs and the prices at the port of each commodity. And one may construct models of rural "feeder roads" that connect with main highways (rather than with a port or market), and by considering the fixed cost of a pick-up, one can develop an optimum stopping system. Network effects may be easily incorporated by multiplying the model on each of the network branches—with some allowance for overlaps, etc.

III. Empirical Evidence

Rather than elaborate the theoretical relationships, however, it is necessary to review empirical evidence to see whether the model is convincingly discredited by the data of development. One of the problems with dealing with such empirical data as are available is that virtually none of it was collected for the purposes of testing a model of this kind. Consequently, nearly all the data on "with-and-without-the-road" situations have not been organized with our purposes in mind.[21]

The predictions of the model may, in principle, be tested in various ways. First, one might reasonably see whether the elasticities of demand for transport in terms of tons or ton-miles as the measure of quantity are in fact consistent with the values suggested by theory. A survey of the empirical evidence, however, shows that there are virtually no firm estimates of the elasticity of demand (or of the percentage increase of generated traffic).[22] One finds occasional references by experienced observers—both engineers and economists—that the percentage increase in traffic (usually ton-miles) due to a 1 percent decrease in ton-mile transport cost is of the order of 1 to 3. But, valuable though these opinions are, one cannot take them as good substitutes for statistics.

One important ex ante and ex post study in Iran has in fact shown that the elasticity of demand for road transport was in fact zero.[23] Although there was considerable improvement in roads and although

    [21] See for example the fruits of the Transport Research Program of the Brookings Institution, George W. Wilson, Barbara R. Bergmann, Leon V. Hirsch, and Martin S. Klein, *The Impact of Highway Investment on Development* (1966).

    [22] Neither "elasticity" or "demand" appear in the index of the Brookings study (*ibid.*), but of course much of the basic data were in fact generated by demand curves. The difficulty was to sort out the movement of the demand curve through time with movements along the demand curve due to the cheapening of transport.

    [23] H. G. van der Tak and J. de Weille, *Economic Reappraisal of a Road Project: The First Iranian Road Loan of 1959* (I.B.R.D., 1966), p. 48 *et seq.*

the cost per ton-mile fell (and transport costs also fell), there was no observable expansion of development traffic. The explanation apparently lay in the noncompetitive structure of marketing and distribution. The middlemen were not forced by competition to increase the prices which they offered for ex-farm produce, and so there was no expansion in the amount of produce offered on the market. The main consequences of the road improvements were to increase the profits of the middlemen.[24]

The case of Iran dramatically illustrates the dependence of the model on competitive behavior. But it does not discredit the model as a useless tool of analysis; the conditions in Iran were analogous to the case of a very inelastic demand caused by the monopoly (or monopsonistic) power of the middlemen. One would have expected, nevertheless, a clustering of productive farms nearer to the road and at a greater road distance from the market. Unfortunately, the data were not available to make such a sensitive test of the model.

This brings us to another way of testing the model; namely, the observation directly of the pattern of cultivation according to road conditions and distance from market. The model predicts that development will be distributed in a triangular form along the road—and it also predicts the dimensions of this development. As we saw above, the shape of the development triangle is determined by the relative cost of motor carriage relative to the cost of headloading.

We have surveyed data for two countries: Liberia and British North Borneo (now called Sabah). The data for Liberia were collected by my colleagues on the Economic Survey of Liberia; the figures consisted of rubber outputs and mileages carried and some information about the location of the farm from which the rubber was tapped. All rubber was supplied to the Firestone plant and was purchased by the Firestone Corporation at known market prices.[25] The cost of headloading a ton-mile was in the region of 50 cents to 75 cents, whereas the cost of motor carriage was about 3 to 10 cents.[26] Of course these figures do not give us a "tight" description of the area of development. Nevertheless, the data showed that there was indeed a triangular pattern in the location of rubber farms.[27] Furthermore, the dimensions of the development areas were not outside the boundaries described by the a-to-b hypothesis—but, of course, this claims very little, since the margins are so wide.

[24] It will also be observed that in those cases where there is a rigid quantitative control of road transport as in South Africa, the benefits of road improvement accrue to those lucky, or politically well-connected, people who possess the authorizations.

[25] An account of the Economic Survey of Liberia appeared in Clower, Dalton, Harwitz, and Walters, *Growth without Development* (Evanston, 1966).

[26] This wide variation was a consequence of various forms of motor carriage—by taxi, by bus, and by truck and according to distance carried.

[27] This information on location was derived from Firestone's technical advisers to private Liberian farmers, and it is thought to be very reliable.

Nevertheless, one cannot claim that the Liberian statistics fairly test the hypotheses of the model. First, there are unique problems connected with land holding and tribal land rights in Liberia which, it might be argued, upset any conclusions to be drawn.[28] The fact that the Liberian data do not discredit the model gives one virtually no grounds for additional faith in the models hypotheses.[29]

The data for Sabah are much more relevant, however, for our purposes. The investigation of the Road Research Laboratory in Sabah was particularly directed at discovering the effects of road construction and improvement on development.[30] It was found that there was an inverse relationship between the acreage of "cash crops" and the distance of the land from the main market. For a well-aligned earth road, one may adduce the equation

$$Y = 400 - 0.2X \qquad \text{for } X \le 60$$

where Y is the number of acres a mile of export crops and X is distance from the main market in miles.[31] At first sight, therefore, the data from Sabah seem to be quite consistent with the triangular hypothesis, and one might well proceed to examine the differential effects of earth roads and all-weather roads. This is shown clearly in the figure presented in the Report. From an I.B.R.D. study we know that the transition from an earth road to an all-weather highway reduces truck costs by a factor of about one-third.[32] Thus, for the same expenditure on road transport one can carry about half as far again. This again is borne out by the figure; for example, the 200 acres a mile band is extended from about 40 miles from the market to about 60 miles when there is an all-weather road rather than the well-aligned earth road.

These results are so consistent with our model that it is necessary to critically examine the data from which they were derived.[33] The first point to be made is that there was not much original data—only nine observations in all![34] (But this is misleading since the observations

[28] It is probably true, however, that land is climatically homogeneous, as far as rubber planting is concerned, since the limit of cultivation had not yet approached the land with less than 80 inches a year of rainfall.

[29] Hence we have not thought it worthwhile to present the detailed statistics here.

[30] See Ministry of Transport, Road Research Laboratory, *Road Research 1964* (London, 1966), p. 136.

[31] *Ibid.*, p. 136. I have translated the diagram into this linear form, partly because I believe that the data are far too few to support any nonlinear hypothesis.

[32] This is a very rough working figure taken from the detailed tables of J. de Weille, *The Quantification of Road User Savings*, I.B.R.D. (Johns Hopkins Press, 1966).

[33] At first sight the only difference between the predictions of our model and the revealed relationships in *Road Research 1964* is that our model would predict a much fatter triangle than that of the Report. However, it is clear that for each acre of export crops there must be several acres of supporting (food) crops. Thus the triangle is fatter than reported. See below and the I.B.R.D. manuscript.

[34] R. S. P. Bonney, *Agricultural Development, Traffic and Road Standards* (Research Note LN/648/RSPB BOR 112, Harmondsworth, 1964).

were for areas comprising many acres—so the situation is not quite as black as it looks.) Clearly, one cannot put any confidence in the subtleties of the calculations. It may be thought to be of some interest that the data do not convincingly discredit the triangular model, but I cannot pretend that anyone should have significantly more confidence in the model as a consequence of the Sabah data. The general result is one encountered so often in applied economics: the model needs further empirical testing. (If, however, the model is thought to be useful in analyzing development effects, then it will be tested in the hands of practitioners themselves.)

In conclusion, it is important to stress that this model is presented not as an orthodoxy which should be applied to all road development projects. It is hoped merely that it will be an interesting and useful way of approaching the problem of measuring the effects of road improvement on development. It represents a way of first sieving the information—of making first conjectures and of deciding where to concentrate one's scarce research resources. Where there is a great shortage of research resources, it is conceivable that some of the rules derived from the model may be the best one can do under the circumstances. But of course this needs much more work.

APPENDIX

1. *Marshall's Laws I and II.*[35]

If we write p_s as the supply price at the point of origin and p_d as the demand price at the point of consumption, then with t as the cost of transport per unit, we have:

$$p_s + t = p_d$$

Treating transport cost as an independent parameter, we can find the derived elasticity of demand for transport ϵ_{trans} in terms of the supply and demand elasticities for the commodity ϵ_s, ϵ_d:

$$\epsilon_{trans} = \tau \left[\frac{\epsilon_s \epsilon_d}{\epsilon_s - (1 - \tau)\epsilon_d} \right]$$

where τ is the ratio of transport cost to demand price $(= t/p_d)$

From this result we derive two limiting cases:

Marshall's First Law

$$\underset{\epsilon_s \to \infty}{\text{Limit}} \ [\epsilon_{trans}] = \tau \epsilon_d$$

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[35] For a full discussion of the derivation and implications of these laws, see E. Bennathan and A. A. Walters, *The Economics of Ocean Freight Rates* (to appear).

Marshall's Second Law

$$\underset{\epsilon_d \to -\infty}{\text{Limit}} \left[\epsilon_{\text{trans}}\right] = \frac{\tau}{\tau - 1}\, \epsilon_s = -\frac{t}{p_s}\cdot\epsilon_s$$

In the context of this paper, the main interest is in Marshall's First Law, since, given that one knows the fraction of transport cost in final price, it is possible to translate the elasticity of final demand into an elasticity of demand for transport. (Note that Marshall's Second Law, although not to be found in the *Principles* and seemingly appropriate to the model considered in the text, is in fact not applicable because of indeterminacies.)

2. *From ϵ_d to η^**

For the definitions given in the text we have

$$\eta^* = \frac{k - f}{A}\, \frac{dA}{d(k - f)}$$

$$= \frac{d \log A}{d \log k} \cdot \frac{k - f}{k - k\dfrac{df}{dk}}$$

$$= \tau\epsilon_d \cdot \frac{1}{(1 - df/dk)}$$

where ϵ_d is the total elasticity of demand.

We observe the simplification $df/dk = 0$ is equivalent to Marshall's First Law—as indeed it should be. Alternatively, this may be expressed in total elasticities with respect to $k(\epsilon_d)$ and with respect to f (say ϵ_f)

$$\eta^* = \tau\epsilon_d \frac{1}{\left(1 - \dfrac{k\epsilon_d}{f\epsilon_f}\right)}$$

$$= \tau\epsilon_d \frac{1}{[1 - (1 - \tau)^{-1}\epsilon_d/\epsilon_f]}$$

Since k and f are functions of A, however, we can often insert the value of df/dk directly into the equation above.

3. The change in area of cultivation due to an increase in the length of a truncated road.

Let the area of cultivation forgone by the truncation of the road at x_0 be $\bar{A}$ (with $b = 1$)

$$\bar{A} = (k - ax_0)^2(1 - a)/a$$

Thus:

$$\frac{d\overline{A}}{dx_0} = -2(1-a)(k - ax_0)$$

and this is, of course, negative for appropriate values of x_0. To find the area gained by a small increment in length of the road, we merely take the positive value.

4. To find the elasticity of demand for transport when the (net) elasticity of demand is η^* (finite), we show that:

$$\epsilon_{\text{trans}} = \eta^*/(2 - \eta^*)$$

Let road improvement be from \$$a$ to \$$a(1-\lambda)$ per ton-mile

$$\epsilon_{\text{tons}} = \underset{\substack{\psi \to 1 \\ \lambda \to 0}}{\text{Limit}} \left[-\frac{1}{\lambda}\left(\frac{\psi^2}{1-\lambda} - 1\right) \right]$$

$$\eta^* = \underset{\substack{\psi \to 1 \\ \lambda \to 0}}{\text{Limit}} \left[\left(\frac{\psi^2}{1-\lambda} - 1\right)\left(\frac{1}{\psi - 1}\right) \right]$$

Thus:

$$\epsilon_{\text{tons}} = \underset{\substack{\psi \to 1 \\ \lambda \to 0}}{\text{Limit}} \left[\eta^*\left(\frac{1-\psi}{\lambda}\right) \right]$$

This is indeterminate at the limiting values. But defining: $\phi(\lambda) = 1 - \psi(\lambda)$ and using Taylor's theorem for ϕ

$$\underset{\lambda \to 0}{\text{Limit}} \left[\frac{1-\psi}{\lambda} \right] = \phi'(0)$$

Since we may find

$$\phi'(\lambda) = -\psi'(\lambda)$$

$$\psi(\lambda) = [-\eta^* \pm \sqrt{\eta^{*2} - 4(\eta^* - 1)(1-\lambda)^{-1}}]\left(\frac{1-\lambda}{2}\right)$$

$$\underset{\lambda \to 0}{\text{Limit}}\, \psi'(\lambda) = \frac{-1}{\eta^* - 2}$$

Thus

$$\epsilon_{\text{tons}} = \eta^*/(2 - \eta^*)$$

TRANSPORT POLICIES FOR EUROPEAN ECONOMIC INTEGRATION

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Let me begin with the most complete of all disclaimers: although I am now an employee of the Department of Transportation, I have never, in an official capacity, even heard of any of the issues I am going to talk about today. So far as I know, everything I have to say is not only unofficial but also completely irrelevant.

Having said this, let me continue the detour with a series of observations which stray amid the less disciplined disciplines. First we will celebrate the approximate sesquicentennial of some diplomatic doggerel. Then we will spend a few moments with *die Lorelei*. Finally we will return to history with the first appearance of Lorraine—long before Joan of Arc and even before General de Gaulle.

I

The diplomatic doggerel was written by George Canning, when British foreign ministers could still afford to be patronizing about the economies of Western Europe. It was a despatch to the British ambassador to the Netherlands, and went as follows:

> In matters of commerce, the fault of the Dutch
> Is giving too little, and asking too much;
> The French are with equal advantage content—
> So we'll clap on Dutch bottoms just twenty per cent.

The main theme of this paper may be stated by a slight revision of Canning's jingle, to make it read as follows:

> In matters of commerce, the fault of the Dutch
> Is asking too little, and giving too much;
> The others comparative 'vantage resent
> And would clap on Dutch freight rates a minimum rent.

You will note that I had to take certain liberties with "comparative advantage" in the interests of scansion. Much of the trouble with transport policy in the European Economic Community has been due to a tendency to take liberties with comparative advantage in the interests of almost everything else. So let us retreat to the ninth century. But first, let us observe our present surroundings.

II

These surroundings consist, at first, of some rocks encrusted with old wrecks and romantic legends. The important transportation fact about

die Lorelei is that they are, as they always have been, the most impor-
tant impediment below the Rhine Falls to the navigation of the Rhine.
But in spite of their ugly reputation, they are not really very impres-
sive hazards. By contrast, they illustrate the remarkable qualities of
the Rhine, generally, as a navigable river. Here are a few transport
facts related to this stream:

1. The Rhine fleet is responsible for one-fifth of all the ton-miles of
freight transported within the boundaries of the European Economic
Community.

2. Rotterdam, on one of the mouths of the Rhine, is now the world's
premier port in terms of tonnage. The vast majority of Rotterdam's
tonnage is transshipped, and the vast majority of this transshipment
involves transfer between ocean-going vessels and the Rhine fleet.

3. The ports at the mouth of the Rhine or in direct water communica-
tion with the lower river (e.g., Antwerp and Amsterdam) are responsible
for more total tonnage than all European ports combined, around the
coasts of Europe from just south of the Rhine all the way to Istanbul.

4. Aside, perhaps, from the relationship of Egypt to the Nile, there is
probably no national economy so riverine as that of the Netherlands.
Much of the country was literally created by controlling and extending
the Rhine delta. Its very independent existence may be attributed, in
part, not only to the ability to flood out Spanish armies in its struggle
for independence, but also to the disinclination of any of the major
Western European powers to see the mouths of the Rhine in the posses-
sion of any other major power.

5. This diplomatic importance of the Rhine is suitably reflected in
the fact that the present web of international treaties relating to trans-
port uses of the Rhine can be traced back to the Congress of Vienna.
Although the international agreement which now controls Rhine pas-
sage, the so-called "Act of Mannheim," bears the name of a less glamor-
ous city, it nevertheless dates from as long ago as 1859 and hence has
acquired a patina of its own. The Act of Mannheim provides that inter-
national navigation of the Rhine is free—free of tolls and free of govern-
mental economic controls. Since the carrying trade between German
ports is subject to governmental minimum rate regulation, the anom-
alous result is that international freight rates on the Rhine are different
from, and typically lower than, rates for shipments of comparable
length entirely within Germany.

6. The inland center of Rhine shipping activity is located at its
confluence with the Ruhr. Duisburg, which controls this strategic
location, is easily the largest inland port in Europe. The Ruhr has in
the past been the principal source for both steel and coal to supply
downstream areas and overseas buyers. The steel still floats downstream;

but American coal and the oil of all the world are now reversing the traditional energy flow.

7. The Rhine is simplicity itself geographically and very complex hydrologically. A line on the map drawn straight north from Basel would not only describe its course in general but also come remarkably close to its course in detail. Then, after an elbow bend, it proceeds almost due west through the Netherlands to the North Sea. Hydrologically, however, a complete description of the Rhine would be exceptionally complicated. The Rhine is an Alpine stream from its source through Basel and well into Germany: its highest water levels are achieved in summer, when the river is fed by melting snows. The more northerly tributaries combine to reverse this summer peak. Since carrying capacities on much of the German part of the river are limited by the draft of the vessel, and since the draft of the vessel is limited at certain points (especially *die Lorelei*) by the level of the river, Rhine freights reflect liquidity preference: high water, low prices.

8. Ice is a less persistent problem than water, but more complete in its constraints when these are in operation. The Rhine is usually closed to navigation along part of its length for brief periods each winter; and, on one occasion a few years ago, it was closed by both ice and low water for six weeks or even two months in succession. Thus the Rhine is not an effective competitor for products which require speed or even complete regularity in delivery.

Here, then, is the transportation backbone of the European Economic Community: straight, generally free of natural obstructions, capable of bearing 1,500-ton vessels throughout most of its navigable length, and passing near some of the most famous coal deposits in the world; but subject to seasonal irregularities of flow, some icing danger, and considerable international rivalry in spite of the Congress of Vienna. To vary the metaphor, the Rhine is not only the backbone of the European Economic Community, but also the most important single key to Common Market problems in developing a common transport policy.

III

To revert to history: this key must turn in an exceptionally rusty lock. Here we pass from the profane to the sacred, from *die Lorelei* to Louis the Pious. As any student of French philology knows, the medieval equivalent of Franglais first emerged, as a sort of dog-Latin, in the Treaty of Verdun in 843. The political significance of this Treaty was that it divided up Charlemagne's empire among the three sons of Louis the Pious. Lothair, who received the middle part, got not only the richest share—including the ancestral homeland of the Carolingians—

but also the unenviable portion which always falls to the third man during the working out of problems in bilateral monopoly. For eleven hundred years, the politics of Lotharingia worked, geographically as well as every other way, at cross-purposes with its economics. The fertile hour-glass of Western Europe has its base in the Po Valley and its top in the sands of the North Sea. To this day, it reproduces with remarkable fidelity the contours of Lothair's kingdom. But this fertile hour-glass is divided among all the members of the Common Market, plus one nonmember—Switzerland. So the direct route up the Rhine or the Seine and then over the Alpine passes is subject, in spite of the internationalization of the Rhine, to as many as seven different transport policies and an equal number of transport systems which were sometimes designed to inhibit cross-frontier movements rather than to encourage them. To take an obvious example: a student without a political map would be utterly at a loss to explain the importance of one of the main railway lines of France, from Dunkirk through French Flanders and Lorraine to Metz. With a political map, he would observe immediately that this line almost exactly parallels the Belgian border.

The importance of Lotharingia to Western Europe doubtless helps to explain why the Treaty of Paris, which established the European Coal and Steel Community, preceded the creation of the European Economic Community via the Treaty of Rome. Lotharingia as a historic entity certainly explains why the proposal for the first-named community is known, after an Alsatian statesman, as the Schuman Plan. But the very virtues of the Schuman Plan, and of the subsequent Treaty of Rome which established the full European Economic Community, served to throw certain economic and transport problems into sharper relief. Here are a few examples:

1. Although this may not be true as a matter of pure theory, it may be stated as an axiom of the new-born science of stochastic geography that creation of a common market is likely to attract economic activity toward those areas whose development was previously most warped by the artificial effects of international boundaries. How, specifically, does this axiom fit Western Europe? I am forced to repeat: by enhancing the importance of the Rhine Valley. But, granted that the heart is pumping more strongly than ever, it need not follow that more nourishment is reaching the extremities.

2. This general observation is important for transport policy in the European Common Market for two reasons. The first, of general significance, is that transport costs and service are likely to seem of greatest relative importance to precisely those areas which are farthest removed from the economic center. The second, which is true under the specific conditions of Western Europe, is that practically all of the areas with

lowest average income in each of the three largest countries are on the geographical periphery: Sicily, Sardinia, and Corsica; southern Italy, western France, and those parts of eastern Germany in the shadow of the border with Communist countries. Conversely, the central industrial area of Lotharingia, potentially the greatest gainer from a Common Market, was already the most prosperous.

3. It scarcely seems a historical accident or a result of a quirk of personality that the Coal and Steel Community preceded the European Economic Community. Lotharingia was best off in large part precisely because of its possession of high-technology and high-wage modern industries, such as metal fabrication and chemicals. These, in turn, historically rested on exactly the resource base which provided the core for the Coal and Steel Community. Moreover, the priority of the Coal and Steel Community foreshadowed three further developments: the fact that transport policy was considered to be important from the outset, as it always must be important to problems involving the assembly cost and final delivered price of steel; the additional fact that inland navigation policy would receive even more emphasis than the general importance of the Rhine would give it, due to the special geographical and functional position of the Rhine and its tributaries with respect to coal and steel; and, finally, that the first step towards a common Western European transport policy would be taken primarily in the interests of coal and steel, and not primarily in order to achieve the most rational organization and functioning of transportation, as such.

IV

This emphasis on prices and market conditions extrinsic to transportation explains much of the framework of the transport policies of the European Coal and Steel Community, and also explains much of their success—both absolute and relative to the lack of success of the transport program of the European Economic Community in its first decade.[1]

In the decade 1952–61, the products subject to the authority of the Coal and Steel Community—coal, ore, scrap, iron and steel products— made up some 50 to 55 percent of the railroad freight tonnage and 20 percent of the inland water tonnage of the Common Market countries.[2]

[1] An unclassified Department of State cable which has just come to my attention announces that " . . . the Council of Ministers . . . at its December 13–14 meeting agreed to the principles of a common transport policy for the European Community." As I understand the rest of the cable, the agreement relates primarily to road transport, and affects rate and entry policy only by introducing "a bracket rate system." Therefore, unless I misread the cable, the "principles" do not include agreement on rail and especially on inland water rate policy.

[2] High Authority, European Coal and Steel Community, *C.E.C.A., 1952–62* (Luxembourg, 1963), p. 386.

Thus it would seem that a successful transport policy for coal and steel products might go a long way toward the accomplishment of a successful transport policy for all products. But the areas of greatest success for the Coal and Steel Community were precisely those whose main significance has been in the establishment and maintenance of delivered steel prices within the Common Market countries. Internationalization, directed mainly at the achievement of a greater approach to uniformity in the transport pricing systems of the Common Market countries, has also achieved some success for the raw materials and products of the Coal and Steel Market. The least successful aspects of the transport policies of the Coal and Steel Market have generally been those of most significance for the general development of transport policy within the Common Market, for these least successful efforts have been those mainly concerned with the economics of transport rather than primarily with transport as a contributor toward steel assembly and distribution costs or as a pure exercise in attempted harmonization of differing national policies.

To sum up the last, long paragraph: the coal and steel transport policy was most effectively exploited in the interests of achieving a new international basic-point system for steel products and some raw materials.

The very creation of the Coal and Steel Community was designed to make the steel industry and its raw material suppliers more competitive within the Common Market. But, as students of American industrial development know, any stimulus to geographical competition—whether it arrives via a cheapening of transport or by a reduction of trade barriers—is likely to produce a countermovement for some modification of this stimulus. In the United States, revolutionary transport improvements in the second half of the nineteenth century created broad new market horizons which in turn provided new incentives both for industrial mergers and for the growth of cartel-like organizations as well as new incentives for high industrial tariffs. In the Common Market, removal of tariffs has given new urgency to the search for alternative forms of geographical market segregation.

An important exception must be noted to this cynical observation that the successful portions of the transport policy of the Coal and Steel Community were designed to moderate the competition to be anticipated from the dismantling of other trade barriers. This exception relates to "subsidizing" or "sustaining" tariffs granted by the German railways to and from certain eastern and southern locations, and by the French railways to the iron ore producers of the Pyrenees and the coal and steel producers of the center and southwest, to enable them to receive cheaper raw materials and to reach wider markets. By no

means all of these special national tariffs have been removed—and their survival is an important illustration of the dilemma of how to reconcile greater reliance on comparative advantage with some restraint on the drift toward Lotharingia. But a good deal of progress has been made in at least restricting rail tariff reductions for out-of-the-way regions to those required to enable producers in these regions to "meet competition." Thus the classic basing point doctrine of meeting competition has at least been applied to freezing inefficient producers out of new sources of supply or new market areas.

For the rest, the successes of the Coal and Steel Community—in forcing a much greater approach toward uniformity in internal rail rates on coal and steel, in reducing or eliminating the use of double distance tapers in freight tariffs applicable to international movements, and in developing a consistent policy for the proportionate relationships of tariffs on such commodities as coal and coke—have been less interesting for present purposes than certain coal and steel failures.

The first of these failures is essentially a product of weighted averages. The Coal and Steel Community was deeply preoccupied with rail rates and with problems of inland water pricing and competition. In general, this bias was justified: only about 10 percent of the tonnages of interest to the Coal and Steel Community moved by road, as against a road movement of 50 percent of the tonnage of all commodities transported in the six countries.[8] The share of road transport in the international movement of coal and steel products in 1961 was only 2.6 percent.[4] So the High Authority of the Community was practically forced to tie road rate policy to rail rate principles, but to run up against extreme difficulties in reconciling international with internal conditions in the process. The preference of the Coal and Steel Community for rigid and published truck rates ran up against the fact that only the German Federal Republic had such an internal policy. Both the Dutch and the Italian governments were particularly opposed to the idea of general publication, and their opposition produced some of the most complicated litigation and negotiations in the history of Western European transport.

The second failure relates directly to the basic conflict between steel policy and transport policy which has been mentioned so often already. Given the resources, industrial structure, location, and historical development of the Netherlands, any Dutch government would have to be more interested in transport policy than in measures primarily

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[8] H. H. Liesner, "The European Coal and Steel Community," Study III in J. E. Meade (ed.), *Case Studies in European Economic Union* (London, 1962), p. 341. The Liesner study is an excellent source for the formative period of Coal and Steel Community transport policies.
[4] Statistical Office of the European Communities, *Informations Statistiques*, 1962, No. 4, p. 309.

designed to simplify the operation of a multiple basing point system. This basic national position has been reinforced by an insistence in the Netherlands, as in no other Common Market country, on avoidance of government subsidy for the national railroads. A list of the attributes of Dutch railroading would make the managements of the New Haven and the Jersey Central rejoice at their easy lives. In the Netherlands, all hauls are short; canals are used for practically all of the bulk traffic and about two-thirds of total tonnage; about half of rail receipts come from passengers; common-carrier trucking is subject to fewer restraints, as to entry, routes and services, or pricing, than in any other country in Western Europe; both inland waterways and road carriers are also the most efficient in Western Europe. Faced with problems which are no more daunting, the Belgian railways manage to roll up deficits equal to about half of total receipts. Yet, until very recently, the Netherlands system was self-supporting—even on the basis of reproduction-cost depreciation and a requirement that this nationalized undertaking appeal independently to the capital markets. This kind of result is not achieved by the waving of wands. On freight service, the Dutch are convinced that the achievement is possible only because more than 90 percent of the freight tonnage handled by rail is moved on rates which are determined by individual and secret contracts.

Therefore the desire of the High Authority for "open covenants, openly arrived at" came into direct conflict, not only with the comparative advantage of Dutch trucking concerns, but also with the basic philosophy of Dutch railroad policy. The sequel to this collision will be described in the next section. Within the confines of the Coal and Steel Community, a compromise was worked out which involved expansion of Dutch reporting of actual rates to the High Authority combined with publication by the High Authority of an unrevealing list of routes and commodities with respect to which special rate agreements are in force.

Finally, we arrive at the root of all the dissension: rate policy for Rhine traffic. Between 1950 and 1959, the proportion of total inland navigation tonnage belonging to owner-operators increased from 37 percent to about 50 percent.[5] This does not necessarily mean an approach to a purely competitive market, even for international movements on the Rhine which are not subject to governmental rate or capacity controls. Some 85 percent of all Rhine tonnage is controlled by traffic pools, in addition to a further 10 percent subject to direct control by the German government over internal movements.[6] But it does mean that the long tradition of freedom from governmental rate

[5] Brian T. Bayliss, *European Transport* (London, 1965), p. 27. This book is probably the most complete survey of its topic available in English.
[6] *Ibid.*, p. 131.

regulation on international Rhine movements is reinforced by the organization of the industry. Moreover, the Dutch Rhine fleet not only dominates the international total but is especially important in the small-owner category. Finally, the interests of the Dutch ports favor lowest rates and maximum tonnage on the Rhine to meet the competition from non-Rhine ports from Hamburg and Bremen to Dunkirk and Rouen. This many-sided Dutch interest in avoiding controls of entry or minimum rates on the Rhine is not offset by any really crucial interest of the steel industry in the other direction. Before the advent of American coking coal, Rhine movements of products subject to the Coal and Steel Community were dominated by the shipment of overseas iron ore from Rotterdam to the Ruhr. So neither basing point reasoning nor considerations of equalizing international competition deserve much practical weight as an offset to the Dutch position.

It is not surprising, then, that no system of controlling international rates or tonnages on the Rhine could be developed within the Coal and Steel Community. The High Authority was not an irresistible force; and the Netherlands continued to be an immovable object.

The legacy of unresolved transport pricing questions which was passed from the narrower Coal and Steel Community to the broader European Economic Community therefore included the possibility of rigid minimum rates, and the question of rate secrecy or publicity.

V

And so we raise the curtain on the last act of our drama. The scene is the same and so are the characters. The time is a decade later. The argument has been incessant; and until December, 1967, almost nothing whatever had happened. If the transport failures of the Coal and Steel Community could be summed up in a few paragraphs, the transport success of the functionally broader European Economic Community could be summed up in one word: nonexistent.

But the process of arriving at the present stalemate has been singularly fruitful in the development and presentation of transport theory, as each rival has attempted to explain and defend his own system and his own views as to the proper international system of regulation of transport prices and capacity. Therefore this section will concentrate on the theoretical innovations which have appeared in the European discussion. But it must first introduce the cast of characters with greater care than has been achieved so far.

First, there is the doughty champion of market freedom: the Netherlands. As has already been stressed, the Netherlands stands for a maximum of freedom from government control in transport pricing and a minimum of publicity for the prices finally charged. This attitude tends

to be a reflection of the policies already applied within the country to produce the freest internal transport market in Western Europe. It has already been pointed out that the Netherlands Railways haul at least 90 percent of their total freight under the terms of secret contracts with individual shippers. As for inland waterway and truck transport, the conditions for entry are practically identical. In each case, the introduction of new capacity (by new or old firms) is subject to public control in the internal market. But this control is not severe and is sensitive to economic conditions. In trucking, for example, the authorities control new capacity for both common carriers and private trucks, on the basis of criteria such as the trend of the ratio between truck capacity and industrial production, truck capacity and ton-miles hauled, and percentage of firms not making what is considered to be normal profits.[7] Meanwhile, legal powers to set truck minimum rates have not in fact been exercised, and the market value of a license tends to be low. Minimum freight rates are established governmentally, however, for international truck transport by Netherlands truckers. Prices for inland navigation follow exactly reverse principles: free internationally, controlled internally. The internal tariff provides our first example of the bracket tariff—a form which has been at the center of the dispute as to Common Market policy. This tariff is combined with assignment of cargos by rotation; actual tariffs are determined by regional committees including equal numbers of shippers and carriers, over a range of from 80 percent to 135 percent of standard tariffs.

Thus, although Dutch freight transport is freer of government controls and regulation is generally more consistent from mode to mode than in any other Common Market country, the market is neither purely nor freely competitive. But it is still competitive enough to give the Dutch a logical foundation for their arguments in favor of greater international freedom in rate making in addition to the strong pragmatic foundation which is provided them by their comparative advantage in both water and road transport.

In the opposite corner from the Dutch, although not their most outspoken antagonist, is West Germany. In view of the ink spilled in the United States over the years about the German "economic miracle" and the contribution of economic liberalism to it, it may be worth emphasing that use of the word "liberalism" to describe the economic policy of the Federal Republic is, at most, the description of a trend and not of an actuality. In spite of a long German tradition of pioneering excellence in location theory and in spite of West Germany's possession of more university transport institutes than all the rest of Western Europe combined, actual transport policy has been both authoritarian

[7] Bayliss, *op. cit.*, p. 95.

and anti-economic. Until recent years, standard value-of-service arguments were reinforced by "collective economy" arguments to justify perhaps the most elaborate system of internal subsidization ever carried out by a railroad system—combined, as it has tended to be in all Common Market countries except the Netherlands, with external subsidization. The profit opportunities created for trucking by the attempt to retain old-time principles of value of service for rail rates have been counterbalanced by Draconian controls over long-distance truck movements; rigorous control of capacity, amounting for long periods to practical denial of new operating rights and reflected in high market prices for licenses to haul freight for long distances; very strict control over rigorous minimum prices for long-distance trucking; and a special tax on long-distance movements by private truck which was at five pfennigs per ton-kilometer for most of the postwar period, and is now the object of a new government proposal to restore the five-pfennig rate in place of the present one pfennig. Five pfennigs per metric ton-kilometer is equal to considerably more than two cents per short ton-mile—in addition, of course, to fuel taxes which are very heavy in Germany as well as in France and Italy among Common Market countries. Inland navigation policy has left more scope for private cartels, but not much more scope for free price competition. Such flexibility as exists in German inland waterway rates and entry conditions must doubtless be explained by the pressure of free international competition on the Rhine.

We may skip over Italy, as rather remote from the cockpit of Common Market transport policy, and Belgium, as tending to work out policy compromises giving some reflection to all surrounding influences. This leaves France, which has usually been the spokesman for the five majority countries on Common Market transport policy and is the possessor of a transport policy whose *dirigisme* is not even always second to the German. On rail rates, the French position is very different from the German. The French National Railways have made the most systematic effort in the world to place all freight rates between a floor consisting essentially of short-run marginal costs plus all costs of rolling stock, and a ceiling determined by the opportunity cost, commodity by commodity, of truck shipments. Moreover, the French railways may cut applicable rates 15 percent below official rates; and they may sign secret rate agreements. So their flexibility falls between the Dutch and German positions. But French inland navigation is more constrained than that of any other country. The capacity of common carriers is frozen on essentially a ton-for-ton basis, which even lowers actual tonnage as more efficient vessels come into service. Internal rates are rigidly set by the government, with the only variations designed

solely to reflect differences in canal and stream water levels. Trucking falls between rail and water. Entry is rigidly controlled, and the market value of long-distance trucking licenses is about as high as in Germany. The last increase in quota capacity for long-distance trucking amounted to about 10 percent, but applications for this new capacity came to over 50 percent of the capacity previously authorized. Road tariffs are based on a complicated system which allows lower rates for directions of empty back haul and in other respects differs considerably, though not fundamentally, from rail tariffs. Actual tariffs may be varied over a total range, plus and minus, running for various commodities from under 10 percent of official tariffs to over 25 percent.

Now that we have completed our Grand Tour, let us concentrate briefly on the areas of agreement in Common Market transport policy.

First, the Netherlands is the only country to impose government regulation on private trucking, and authorities agree that this regulation has little restrictive effect. So private trucking can be regarded as internally free everywhere. All countries expect it to remain free throughout the Common Market.

Second, for both trucking and inland navigation, no one confuses a "free transport market" with the kind of transport market that might result if something like the Sherman Act were applied to transport. In fact, the transport sector is now exempt from the anticartel features of the Treaty of Rome, although this exemption is temporary.

Third, for truck transport, every Common Market country has managed to avoid, or to graduate from, the kind of dead hand which guides the regulation of common carrier trucks in the United States. For all the explanations of why trucking should be governmentally-regulated in Western European countries, the fact is that regulation of short-distance trucking is generally not severe and is often nominal. The much tighter regulation of long-distance trucking of course reflects the influence of national railroad systems. In some countries it also reflects a desire to try to salvage as much of pretruck value-of-service pricing as possible. But long-distance trucking regulations control capacity, not firms; quotas are global, not—as in the United States—fractured by commodity, by origin and destination, by route or gateway, and so forth. Thus the European system at least avoids the many sources of secondary inefficiency which have put the U. S. trucking industry at such a needless long-run disadvantage in the face of private trucking and possible railroad rate cuts.

Fourth, except in Germany the tendency has been toward the introduction of some flexibility into truck and even rail rates. Rigid French inland water rates are of limited international importance because of the isolated geographical position of much of French inland navigation,

and the obsolescence of many French canals. Otherwise internal trends have been toward the *tarif à fourchette* for rail as well as its competitors; i.e., a forked or bracket tariff which permits the transportation enterprise to shade official published rates. It should be noted that the bracket tariff is an entirely different concept from the additional idea, used by the French railways, of a "fan" or spread between official rate floors and rate ceilings.

The foregoing summary of likenesses and differences can now be carried directly into the areas of maximum disagreement in present[8] European Community transport rate policy. All members except the Dutch had, by 1965, managed to reconcile their own internal differences to offer essentially the following plan for international freight transport in the Community: (1) bracket tariffs for all transport modes except inland water, with the brackets to be set initially at plus or minus 10 percent of the official rates and with the hope of subsequently narrowing them; (2) "reference tariffs" for internal navigation, combining *de facto* rate freedom with a reporting requirement for all rates which departed by more than a specified percentage from the reference tariffs themselves; (3) complete tariff publicity. This already represented a major concession from previous positions. The reference tariff was an innovation designed specifically to solve the special problem of international freight traffic on the Rhine. But the Dutch would have none of it. They insisted on more tariff freedom, and more tariff secrecy. And, to quote Professor C. J. Oort, of the University of Utrecht, "... the over-all picture of the Community's transport policy is one of an almost complete deadlock."[9]

And now, after this long historical account, what economic principles can be cited? Answers are nicer; but questions are quicker. So let us save our time.

As railroads face increasing competition for freight, they pass from something approaching monopoly to an extremely complex form of differentiated oligopoly, or to the analytically baffling position of a whale that has been trapped in shallow water and is being attacked by barracuda.

Question Series Number One: Is not publicity the enemy of price reductions in oligopolistic situations? And in an industry where the problem is to raise the rate of return, can publicity of prices be reconciled both with maximum price reductions and with profit maximization? On the other hand, are residual areas of rail monopoly still so important that secret rates would merely open the door to all kinds of monopolization elsewhere in the economy? And—to bring the whole discussion

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[8] Written before Dec. 18, 1967. See footnote 2.
[9] "Frustration in Transport," *Common Market*, Nov., 1967, p. 276.

closer to home—is a secret rate something that a monopoly railroad can use more, or less, effectively for itself or beneficially for the public, than a competitive railroad? And are there public policy reasons why a nationalized railroad should have more freedom or less freedom to establish secret rates? Is the whole American tradition of the published railroad rate simply a historical relic of Grangerism, old-fashioned trusts, and the desire of railroad managements to fashion government-sponsored cartels? Or is rail rate publicity a valuable social goal in itself?

The second bone of contention is the issue of fixed and flexible freight rates. Rigidly fixed rates are gradually fading from the Western European scene, except in Germany. So the Common Market battle was joined on the issue of relatively fixed rates, free to move over the range of a bracket, and rates capable of moving over a wider range. The truth is that flexibility of transport rates, as such, has never received much theoretical attention, possibly because in the heyday of the railroad such flexibility often took the clearly temporary form of violent rate wars which were often exaggerated by the extreme rigidity of the rates which had preceded them. So the questions raised on this position must be highly tentative and preliminary.

Question Series Number Two: If bracket rates are adopted, can any bracket be defended which is not as wide as the difference between the lowest possible level of relevant marginal cost of the transporter (say, short-run marginal cost) and highest level of relevant opportunity cost? Under modern conditions, is there any theoretical basis for rate ceilings at all? If they simply represent the opportunity cost of alternative transport methods, possibly corrected for service differences, do they not simply try to define the area of high cross-elasticity which the transporter would seek anyway? If average costs are, in some sense, adopted as the appropriate basis for maximum rates, how does one deal with the problem that the average depends on the whole rate structure? Or the further problem that, except in constant-cost situations, the whole idea of average-cost rate-making involves circular reasoning? Granted that transport capacity might be used more effectively over the year if seasonal rate flexibility existed, can this possibility be handled by a rate bracket system—and, in general, how important are the opportunities thus presented? Finally, is it true under modern conditions that plant locations are peculiarly influenced by transport rates, and that free transport rate decisions might play havoc with both the location of industry and the long-run vigor of industrial competition?

Whatever your own answers to these and many other possible questions, the fact remains that the Economic Community transport dispute has once again revealed the enduring strength of economic and

political geography. A Dutch socialist was for years one of the leading political proponents of greater rate freedom. A French libertarian was one of his main opponents.

And through all this flows the Rhine. How can international Rhine rates be controlled without upsetting the whole system of Common Market transportation and without disrupting an organization which has already withstood massive shifts in the coal trade, the appearance of oil pipelines, and the introduction of revolutionary new forms of navigation? Conversely, how can other rates be controlled if international Rhine rates are left free?

Let us close with a familiar line from Heinrich Heine:

> Und das hat mit ihren singen,
> Die Lorelei getan.

DISCUSSION

GUSTAV RANIS: The Roberts-Kresge paper represents a very interesting and ingenious application of a complete mutual interaction feed-back model to the specific problem of grafting a transportation sector onto a conventional macroeconomic system. It has the distinct merit of introducing the important spatial dimension into the conventional consistency model in the input-output tradition by the determination of modal and routing choices which minimize cost for a given regional demand and supply pattern. The application of the model to the particular case of Colombia is, moreover, highly appropriate, given the unusually difficult topography of that specific less developed economy.

The avowed intent of the model is to permit the choice of a transportation network which maximizes the growth of GNP. While it is possible to argue about the relevance of such other possible objectives as employment which are likely to be very much affected by the modal transport choice, I am willing to accept the overriding importance of first achieving a better understanding of the relationship between transportation and income growth. The difficulty I have is, rather, with the somewhat narrow scope of the authors' inquiry into that very relationship. For example, on a somewhat technical level, the authors translate the cost-saving resulting from superior transportation choices into changes in GNP under the assumption of an invariant composition of final demand. If we allowed for the possibility of shifting the composition of the additional final demand made possible by the superior transportation choice, say towards investment and away from consumption, the resulting GNP differences over time might be much more pronounced.

More to the point, I doubt that the present model is really in a position to get at the heart of the as yet unexplored relationship between transportation and development. Cost-saving under essentially static conditions is undoubtedly of some importance, but the crux of the matter may well be in the dynamic interaction between the transportation sector and the rest of the economy. The impact of alternative modes and routes on the coefficients of the macro-model beyond those resulting from cost reduction, i.e., via changes in supply conditions in various sectors, is clearly not a *de minimis* matter.

The questions being debated in most of the planning commissions around the world almost invariably include such issues as: should we build penetration roads or improve the existing network; how important, generally, is access to commodity markets and financial intermediaries for incentives, and the impact of feeder roads on agricultural productivity, in particular. These questions cannot be addressed with the help of the Roberts-Kresge model; they are, admittedly, hard to integrate into any satisfactory model structure, but to ignore them in any analysis of the relationship between transportation and economic growth seems difficult to justify. It might even be said that exclusive concentration on the comparative cost-saving

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of alternative transport packages might have more relevance to a mature rather than an underdeveloped economy like Colombia.

There exists, of course, another approach to the problem of transportation and economic development in the literature—and that is what might be called the episodal and partial equilibrium approach. There are cost-benefit studies of varying quality on the merits of a particular road or a particular mode of transportation. Many of these studies have been helpful to policy-makers in making project and sometimes even systems decisions in the less developed world. But they do usually suffer from their inability to view transportation decisions in a general equilibrium setting; moreover, they often try to prove, with indifferent success, that transportation constitutes "the" missing link, "the" explanation of the residual in the aggregate production function. Transportation has its strong adherents, as fertilizer and education have theirs. It seems unnecessary to finger any of these as the Hamlet of the development piece. What we need to do instead is recognize the potential importance of such factors for the production conditions in the macro-model and to come up with some testable hypotheses about these relationships. The present paper happens to be a considerable advance over the past, in flexibility, imagination, and workmanlike rigor. Thus far there has been little attempt to marry the practical episodal approach, which tends to claim too much, with the theoretical general equilibrium approach, which tends to claim too little. The real pay-off to the kind of complicated multivariate analysis as discussed here will ultimately have to come through such a marriage, with inductive evidence on parameter changes absorbed within a general equilibrium framework. The task is admittedly ambitious, but then there are no easy roads to the solution of complex problems.

BENJAMIN CHINITZ: My comments will be very brief. I find Walters' model very useful. There is altogether too little of this kind of careful analysis in the transportation field. However, I would suggest further extensions of the model which would bring it into somewhat closer contact with the real world. First, it would be interesting to consider the case in which the natural resources in the interior are superior to those near the coast. Making all of Walters' other assumptions, the resulting redistribution of activity would be different from his findings so far. Second, I would urge the consideration of the case in which there are economies of scale in production. After all, the oldest and still most interesting proposition in transportation is that lower transport costs permit the greater concentration of production when there are economies of scale. Third, there is the case of the island with a great port on each coast and what happens when you build a road across the island connecting the two ports. The same would apply to two urban centers which are connected by a highway.

All three of these cases, it seems to me, can be handled with Walters' basic model and all three are representative of real world situations.

ERIC SCHENKER: Professor James R. Nelson stresses the difficulties involved in the development of a uniform transport policy in the European

Economic Community. Articles three and seventy-four of the Treaty of Rome, establishing the European Economic Community, provide for the introduction of a uniform transport policy. No common market and no gradual approximation of the economic policies of the member states can be envisaged without a uniform transport policy in the Community.

The provisions of the Treaty of Rome do not prescribe the form in which this uniform transport policy should consist. The Treaty merely enunciates certain principles and lays down a number of special rules. For the rest, it mainly outlines the political procedure to be followed.

The difficulties involved in the development of a uniform transport policy for the Common Market were described by Professor Nelson and can be divided into two categories. First, transitional difficulties would arise, regardless of the policies adopted and could be avoided only by maintaining the *status quo*. Adjustments would be demanded of all modes of transport in all countries—adjustments to new competitive conditions, to new cost structures, to new price systems, and to new regulations. Second, difficulties arising from the different transport philosophies hinder the development of a Common European Transport Policy. There is no common theme or philosophy of transport throughout the EEC.

In my article on "European Transportation Policy and the Common Market," I discussed the extent and nature of the different philosophies that exist among member states, both in theory and practice, with the intention of illustrating the problems that must be overcome if a uniform transport policy is to be achieved. It is of little use to merely consider formal statements of policy in preambles to transport acts or ministerial speeches. Agreement on terminology alone, such as "coordination" and "healthy competition," is insufficient. The crucial questions of how is coordination to be achieved and how free should competition be allowed to be, remain unanswered.

In his paper Professor Nelson describes certain aspects of the transport regimes now in force in the EEC. It is intended that this will provide a more useful background than an abstract discussion of attitudes for those wishing to follow the development of the uniform transport policy and to assess the possible adoption of such a policy.

.Discussion within the EEC in the past years has centered around the concept of an extremely liberal uniform transport policy developed by the Commission in 1963, the administrative body of the EEC. The program that it proposes is not a copy of any of the various national policies now in force; rather, it seems to be a compromise, whether or not it was conceived in that spirit. The program is concerned with the elimination of any obstacle that the transport sector might engender toward the establishment of a common market in goods and services. In February, 1967, the Commission sent a report[1] to the Council describing its new program of operations. This new program provides for two phases, the first of which should start immediately and end December 31, 1969, and the second should start January 1, 1970, and be completed within three years.

[1] *Notice to Commission: SEK* (67), 346, Feb., 1967.

Phase I:

1. Start of harmonization of the actual conditions of competition of various modes of transport.

2. Allocation of costs of rights of way: uniform of motor carrier taxation; equalization of rates of taxation on motor vehicles and fuels; check of contribution of inland water transport to cost of inland waterways; preliminary standardization of cost accounting for the different ways of transport.

3. Application of general rules of competition to transportation.

4. Admission to market (motor carriers): passage of regulations governing creation of a "Contingent of Community permits" and adaptation of present bilateral contingents; passage of regulations of EEC governing control of capacity of national commercial motor carriers, rules of qualification of motor carriers, rules of admission of carriers from other EEC-states to national transport markets; passage of rules to end limitations to free entry of carriers to other states within the EEC.

5. Rate system: passage of first step of proposed marginal rate system of October 27, 1965; elimination of restrictions of reference rates; introduction of exempt rates; extension of system of rate publication.

6. Control of transport market: creation of a control commission to enforce regulations of the common transport policy.

Phase II:

1. Completion of a uniform rate system.

2. Extension of the rules of EEC for admission to all sections of the national road and waterway transport markets.

3. Harmonization of conditions of competition: concerning the financial relations between the railway companies and their states; social conditions for railway personnel.

4. Allocation of costs of rights of way: by means of a common finance system for users of public ways and definite equalization of vehicles and fuel taxes.[2]

The basic principles on which the program is based are: equal treatment of the various means of transport, financial independence and freedom of action for firms, free choice for users, and coordination of transport investment. It is to be a competitive system, in which all the forms of transport covered by the program (air and sea transport are omitted at the moment) shall be placed on the same footing, as far as this is possible, to achieve different techniques and organizational structures. Competitive conditions will be aligned through the coordination of fiscal, social, and technical provisions governing transport (this is in line with community policy in all sectors). In this way, it is intended to avoid any artificial differences in the competitive strength of the various national transport industries and of the various means of transport. Under the head of fiscal coordination

[2] G. M. Precht, "European Interstate Motor Problems and Implications of Size and Weight Regulations," *Transportation Research Forum, 1967* (Richard B. Cross Co.), pp. 292–93.

would come a common level of tax on fuel and other imports; under social harmonization, uniform hours of work; under technical harmonization, common construction and use regulations for motor vehicles—to name but a few examples.

Though the program is to be a competitive one, a considerable degree of organization is envisioned for the transport sector. Despite the principle of freedom of action for transport enterprises, it is proposed that they be subject to both capacity limitations and pricing restrictions. Based upon uniform principles, the responsibility for regulations governing both of these areas shall initially be at the national level, and then gradually instituted on a community level.

Although the program does envisage capacity limitation, its proposals constitute a liberation with reference to the *status quo*, especially with regard to international motor carrier transport, where restrictions are most common and most severe. The gradual elimination of the present bilateral quotas and the gradual introduction of a community quota are proposed which would allow carriers licensed for international transport access to any country within the EEC. At the same time, it is hoped that the present quota level be increased to align them with present needs, and that certain restrictions—for example, on return loading—be lifted. The general aim is to introduce an increase of trucking capacity into international transport without upsetting national markets. A common set of entry conditions should be eventually instituted, both with regard to the qualifications of the applicant and the overall level of capacity. For the railroads, the situation is different, as there is no question of the various national administrations competing within each other's territory. With regard to inland waterways, conditions are already fairly free, especially, of course, on the Rhine, as Professor Nelson described.

This is, of necessity, only a brief outline. It does, however, indicate the general lines of EEC thinking and the nature of the adjustments that might have to be made if a system similar to these proposals is accepted. To what extent the generally competitive framework which the Economic Commission has proposed will be accepted is one crucial question still undecided.

The EEC experience shows that there will be no successful uniform transport policy unless the conditions under which the different modes of carriers operate have been coordinated nationally and within the Community. The decisions on "Transport Policies for European Integration" are political by nature and therefore the progress of the uniform transport policy of the EEC will, for a long time, depend upon the willingness of the states to proceed toward a political union. Even when this task has been completed for the EEC, the same problems will remain to be solved among the other European states and in their relations to the EEC. There will be a difficult process of adaptation for each state wanting to join the Community, or wanting to become an associate member. Professor Nelson's paper has demonstrated a futile attempt by the EEC toward a uniform transport policy.

ECONOMICS OF ARMS CONTROL AND DISARMAMENT

THE MONETARY AND REAL COSTS
OF NATIONAL DEFENSE*

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Those attracted to the idea of multilateral disarmament are mainly motivated by the hope that a properly designed international peace-keeping system could more reliably safeguard national security than the present precarious balance of national forces. However, the possibility that a more rational organization of world security arrangements would also permit savings in defense expenditure sufficient to bring about a rise in living standards of at least several percent is hardly to be ignored as a collateral advantage. The potential benefits of free trade— a subject of great fascination for generations of economists—appear rather trivial by comparison.[1] Thus the opportunity costs of the world's military activities or the potential increase in real income obtainable as a result of disarmament seem at least as worthy of the economist's study as the losses occasioned by tariffs or other international barriers to trade.

In an earlier study on, "The World Burden of National Defense" in *Disarmament and World Economic Interdependence* (DWEI), estimates were made of the real costs of defense programs in 36 countries, accounting for approximately 97 percent of the world defense expenditure; and for 24 of these countries, functional breakdowns were attempted as between the main categories of defense activity (personnel, procurement, R and D, construction, operations and maintenance, etc.).[2]

[1] On Dec. 5, 1957, Professor Arnold Harberger, in testimony supporting trade liberalization before the Subcommittee on Foreign Trade Policy (Hale Boggs, Chairman) of the Committee on Ways and Means disclosed an ingenious calculation he had made indicating that U. S. national income might be raised, if all tariffs were eliminated, by (I believe) $200 million to $400 million. Even doubling Professor Harberger's higher estimate, this would have amounted at the time to under a quarter of one percent of national income. The effective degree of protection of our tariffs has been considerably reduced since then. True, the long-term benefits might be higher.

[2] *Disarmament and World Economic Interdependence*, edited by Emile Benoit, with the assistance of N. P. Gleditsch (Universitetsforlaget, Oslo, and Columbia Univ. Press, 1967), pp. 30–59.

Some of the methods used have now been adopted in other studies.[3] The present paper summarizes fundamental aspects of these methods, presents preliminary defense expenditure and related estimates for 1966, and discusses certain factors in estimating the opportunity costs of defense expenditure.

Monetary Costs

We begin with an examination of monetary costs—here defined as the amounts of money (including spendable bank deposits or government credits) actually exchanged for military goods and services or designated as payments for them in government accounts. Such costs are a measure of the sum of money paid, not of the quantity of goods and services bought. But even monetary costs are not as easy to establish as might be supposed.

All nations hide something about their military expenditures. Some like Mainland China hide everything, not even publishing total expenditure. Some of the worst managed probably do not know themselves what they are spending, since payments are on an *ad hoc* hand-to-mouth basis, as part of the internal political struggle for the available revenues, and few reliable records are kept. Some countries may wish to understate defense expenditures for strategic reasons. This can readily be done by not including certain activities by civilians in industry and research that serve defense goals and which would elsewhere be paid for out of the defense budget.

In many countries defense funds are occasionally used to advance nonmilitary purposes, sometimes of a narrowly political character. Conversely, civil functions are often administered in such a way as to contribute to defense goals, possibly at some considerable increase in cost which should logically be charged to defense expenditure but rarely is. Moreover, defense figures differ widely with respect to such items as inclusion of veterans' pensions, border and security police, civilian space and nuclear programs, river and harbor work by military engineers, etc.

Considerable adjustments are therefore required to make the estimates comparable, but adequate information is rarely available for any but the most obvious adjustments, and even when revised, such estimates have a far larger margin of uncertainty and error than their precise appearance may suggest.

The monetary cost estimates for 1966 in column 5 of the table below are derived for most countries from estimates made available by the U. S. Agency for International Development (AID), by the Institute for

[3] Institute for Stategic Studies, *The Military Balance 1967-68*, Tables 3 & 4, pp. 47, 48; U. S. Arms Control and Disarmament Agency, *World-Wide Military Expenditures and Related Data, Calendar Year 1965* (Dec., 1967).

Preliminary

THE WORLD'S MONETARY AND REAL COSTS OF NATIONAL DEFENSE, 1966

	(1)	(2)	(3)	(4)	(5)	(6)
	Real Cost PPE$ (millions)	Real Cost per Capita PPE$	Armed Forces 000	Armed Forces per Thousand of Population	Monetary Cost (in units of national currency) (millions)	Monetary Cost as per cent of GNE %
Superpowers						
United States.........	63,283	322	3,094	15.7	63,283	9.1
U.S.S.R..............	44,500	191	3,165	13.6	—	—
Total...........	107,783	251	6,259	14.5	xx	xx
Other Major Powers						
Mainland China.......	6,000	9	2,486	3.5	—	—
United Kingdom......	5,761	105	438	8.0	2,202	6.1
France..............	4,639	94	523	10.6	26,246	5.3
Germany, Federal Republic...........	4,564	79	440	7.7	19,686	4.1
Total...........	20,964	24	3,887	4.5	xx	xx
Secondary Powers						
Italy................	1,815	35	376	7.2	1,327	3.5
Canada..............	1,705	86	107	5.4	1,734	3.0
India...............	1,283	3	879	1.8	10,360	3.7
Japan...............	1,276	13	246	2.5	307,040	1.0
Poland..............	1,102	35	260	8.2	25,300	—
Sweden.............	1,032	132	57	7.3	4,622	4.4
Czechoslovakia........	1,028	72	220	15.5	10,800	—
Australia............	991	86	69	6.0	753	3.7
Spain...............	954	30	291	9.1	45,218	3.1
Indonesia............	900	9	352	3.3	—	—
Netherlands..........	775	62	129	10.3	2,801	3.7
Yugoslavia...........	742	37	264	13.3		
East Germany........	714	45	122	7.6	3,300	—
Brazil...............	712	8	222	2.6	1,331,000	3.0
Total...........	15,029	15	3,594	2.4	xx	xx
Defense Costs of Approximately $100–$500 Million						
United Arab Republic..	514	17	190	6.3	165	8.1
Belgium..............	505	53	107	11.1	26,527	2.9
Turkey..............	463	14	450	13.7	4,041	5.0
North Korea..........	460	37	368	29.7	—	—
China—Taiwan.......	395	31	544	42.5	9,945	9.1
Pakistan.............	391	4	278	2.6	2,363	4.0
Switzerland..........	386	64	31	5.2	1,673	2.6
Portugal.............	382	41	162	17.4	6,955	5.8

TABLE—(*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)
	Real Cost PPE$ (millions)	Real Cost per Capita PPE$	Armed Forces 000	Armed Forces per Thousand of Population	Monetary Cost (in units of national currency) (millions)	Monetary Cost as percent of GNE %
South Africa.........	375	21	22	1.2		
Israel...............	358	138	71	27.3	1,239	12.2
North Vietnam........	350	18	256	13.1	—	—
Iraq.................	341	40	82	9.5	85	12.5
Argentina...........	326	14	118	5.2	69,088	1.7
Iran................	283	12	180	7.5	22,422	5.0
Denmark............	281	59	50	1.0	2,144	2.7
Rumania............	265	14	201	10.5	4,800	—
Hungary............	245	24	109	10.7	5,219	—
Norway.............	229	62	34	9.2	1,862	3.4
Cuba...............	213	27	121	15.5	—	—
Greece.............	212	25	159	18.5	7,200	3.8
Austria.............	189	26	25	3.4	3,491	1.4
Malaysia...........	178	18	30	3.1	371	4.2
Venezuela...........	178	20	31	3.4	797	2.2
Chile...............	177	20	46	5.3	756	2.9
Finland.............	171	37	40	8.7	454	1.6
Bulgaria............	170	21	156	19.0	240	—
Mexico.............	159	4	62	1.4	2,073	0.8
Saudi Arabia.........	144	22	55	8.5	648	9.5
Colombia............	139	7	48	2.6	1,500	2.1
New Zealand........	132	49	13	4.8	41	2.2
South Vietnam........	129	8	425	25.8	21,594	—
Morocco............	125	9	45	3.3	516	4.0
Thailand............	117	4	126	4.0	2,310	2.6
Peru................	103	9	55	4.6	3,594	2.7
Algeria.............	99	8	45	3.7	490	3.8
Burma.............	110	4	111	4.4	527	6.3
. Total...........	9,294	16	4,846	8.1	xx	xx
Defense Costs of Approximately $50–$100 Million						
Syria...............	95	18	61	11.3	362	9.5
South Korea.........	77	3	572	19.7	14,575	1.6
Nigeria.............	76	1	12	0.2	27	1.4
Philippines..........	66	2	38	1.1	312	1.5
Congo (Kinshasa).....	66	4	32	2.0		5.2
Ghana.............	59	8	8	1.0	42	1.6
Jordan.............	57	27	36	17.1	21	12.8
Cambodia...........	53	8	31	4.9		6.3
Total...........	549	3	790	5.0	xx	xx

TABLE—(*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)
	Real Cost PPE$ (millions)	Real Cost per Capita PPE$	Armed Forces 000	Armed Forces per Thousand of Population	Monetary Cost (in units of national currency) (millions)	Monetary Cost as percent of GNE %
Defense Costs of under $50 Million.........						
Laos.................	35	14	85	34.0		
Ethiopia.............	34	2	35	1.5	85	2.8
Libya................	34	20	7	4.1	12	3.9
Kuwait..............	31	—	5	12.5	111	2.0
Lebanon.............	30	13	11	4.6	95	2.7
Ireland..............	30	10	13	4.5		1.0
Albania.............	28	15	39	20.5	272	—
Uganda.............	26	3	6	0.8	9	3.9
Singapore...........	26	14	2	1.1	—	—
Afghanistan.........	23	2	116	7.5	1,705	1.9
Dominican Republic...	19	5	19	5.0	32	3.2
Ecuador.............	19	4	15	2.8	504	2.1
Zambia.............	18	5	3	0.8	6	2.1
Tunisia.............	18	4	20	6.2	7	1.4
Cameroon...........	16	3	4	0.7	3,826	2.3
Paraguay............	16	8	11	5.2	2,016	3.4
Mongolia............	15	13	18	15.0	60	—
Senegal.............	15	4	6	1.7	3,653	2.2
Guatemala..........	14	3	8	1.7	14	1.0
Ceylon.............	14	1	8	0.7	60	0.8
Ivory Coast.........	13	3	4	1.0	3,160	1.3
Bolivia..............	13	4	15	4.1	158	2.0
Kenya..............	11	4	5	0.5	38	1.2
Uruguay............	11	4	14	5.2	759	1.5
Malagasy............	11	2	4	0.7	2,715	1.9
Guinea..............	11	3	5	1.4	2,715	4.1
Luxembourg.........	10	33	3	10.0		1.5
Mali................	10	2	4	0.9	2,469	3.3
Sudan...............	10	1	19	1.4	12	2.4
Cyprus..............	10	17	32	53.3	3	2.1
El Salvador..........	10	3	7	2.3	26	1.2
Somalia.............	9	4	10	3.8	64	6.0
Nicaragua...........	9	5	2	1.2	60	1.4
Rhodesia............	8	2	4	0.9		
Tanzania............	8	1	2	0.2	3	1.0
Haiti...............	7	2	6	1.3	35	—
Honduras...........	7	3	4	1.6	13	1.2
Guayana............	6	9	1	14.3	10	—
Congo (Brazz.).......	5	1	2	0.2		
Nepal...............	6	1	20	1.9	46	0.8
Niger...............	6	2	1	0.3	1,481	2.4
Jamaica.............	5	3	2	1.1	2	0.6
Dahomey............	4	2	2	0.8	987	2.3
Liberia..............	3	3	3	2.7	3	1.2

TABLE—(*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)
	Real Cost PPE$	Real Cost per Capita PPE$	Armed Forces	Armed Forces per Thousand of Population	Monetary Cost (in units of national currency)	Monetary Cost as percent of GNE
	(millions)		000		(millions)	%
Upper Volta............	3	1	2	0.4	741	1.2
Sierra Leone............	3	1	1	0.4	1	0.8
Trinidad and Tobago..	3	3	1	1.0	5	0.5
Togo..................	3	2	2	1.2	667	1.9
Costa Rica............	3	2	3	2.0	18	0.4
Mauretania............	2	2	1	1.0		
Gabon................	2	4	1	2.0		
Chad.................	2	1	1	0.3		
Central Afr. Rep.......	2	1	1	0.7		
Malawi...............	1	1	1	0.3	1	0.8
Panama...............	1	1				
Burundi...............	1	0.3	1	0.3		
Total............	690	3	617	2.5	xx	xx
Grand Total......	154,309	47	19,993	6.1	xx	xx

Notes to Table on Monetary and Real Costs of National Defense Programs

Column 1

Real Costs in Purchasing Power Equivalent (PPE) Dollars

In the case of the larger defense programs these estimates are updated and revised versions of the PPE estimates for 1964, or earlier years presented in *Disarmament and World Economic Interdependence* (DWEI), pp. 39–41, Table 3. Please see that source for detailed explanations of the original estimates.

Basically, for most countries with substantial defense programs, the present estimates are obtained by converting estimated monetary costs in column 5 of the present table by a constructed exchange rate obtained in one of three ways:

1. Sector prices of major segments of the defense programs on the basis of PPE rates for personnel, consumption, machinery, or construction applied to sectors of defense expenditure deemed to be appropriately deflated by such prices. This method was applied to Denmark, France, Germany, Netherlands, Norway, Italy, and the U.K., utilizing the 1950 and 1955 price comparisons established by the work of Gilbert and Kravis and their associates in the OEEC (now OECD) and updating them by relative changes in the movements of the relevant sectors of the implicit GNP deflators as reported in the OECD *National Accounts Statistics, 1956–1965* (OECD, Paris). (N.B., 1966 estimates are preliminary.) A similar method was applied to the U.S.S.R. based on the estimates of Abraham Becker and Morris Bornstein (see estimates with explanation in DWEI, *loc. cit.*), with adjustments between 1962 and 1966 based on proportional increases in the published defense estimates. The total has been reduced by an arbitrary 5 percent to compensate for possible divergence in relative price trends, or possible decreases in defense-oriented industrial and R and D activity omitted from the official defense estimates.

2. Use of a constructed PPE rate for real consumption, based on estimates of indicated real consumption of Wilfred Beckerman and Robert Bacon in "International Comparisons of Income Levels: A Suggested New Measure," *Econ. J.*, Sept., 1966, and *International Comparisons of Real Income*, Wilfred Beckerman (OECD Development Center, Paris, Sept., 1965). The method is explained in DWEI. In the present paper it is applied to the conversions of monetary cost of defense for the following countries: Canada, India, Japan, Sweden,

Australia, Spain, Yugoslavia, United Arab Republic, Turkey, Taiwan, Pakistan, Switzerland, Portugal, Israel, Iraq, Argentina, Iran, Greece, Austria, Malaysia, Venezuela, Chile, Finland, Colombia, New Zealand, Morocco, Thailand, Peru, South Korea, Ghana, Dominican Republic, Ecuador, Tunisia, Ceylon, Uruguay, Sudan, and Cyprus. However, in the case of Canada, India, Japan, Sweden, Australia, Yugoslavia, Turkey, Pakistan, Switzerland, and Argentina, an adjusted official rate of exchange was used for the procurement sector. (See text.)

3. Use of constructed PPE rates (for the Eastern European countries, other than the U.S.S.R. and Yugoslavia) based on estimates of real per capita GNP as a percentage of West German real per capita GNP from a study prepared for the Joint Economic Committee of Congress, by Maurice Ernst entitled, *Postwar Economic Growth in Eastern Europe.* These percentages were used to obtain per capita national income in PPE dollars which were then divided into the per capita national incomes in national currencies, thus giving an implied PPE rate of exchange.

In the case of Congo (Kinshasa) and Brazil, the "effective" rates of exchange developed by AID were used, and for North Korea, North Vietnam, Cuba, Mongolia and Indonesia, "dollar equivalent" figures from ISS were used.

For the rest of the countries, there was either no 1960 Beckerman index of real per capita consumption available, or if there was such an index, no per capita national income data in local currencies (necessary for converting the index to an implied PPE rate of exchange), or no price data for updating a 1960 rate of exchange. Therefore, their defense costs in column 1 are expressed in dollars at official rates of exchange.

The estimate for Mainland China is directly in PPE dollars rather than achieved by conversion of an estimate in national currencies. It is based on an assumed 10 percent annual growth rate from the level estimated for 1964 in DWEI, *loc. cit.* See the detailed discussion there on considerations affecting that estimate.

Column 2

Real Cost Per Capita

Real costs in column 1 divided by population figures given in the United Nations *Statistical Bulletin* (monthly). In some cases where only 1965 data were available, estimates were made to update them to 1966.

Column 3

Armed Forces

Where available, the number of armed forces were taken from *The Military Balance, 1966–67* (ISS, London), and *Armed Forces in Central and South America,* Adelphi Papers, No. 34, April, 1967 (ISS, London). A secondary source was *The Diffusion of Combat Aircraft, Missiles and Their Supporting Technologies,* Oct., 1966, prepared for the Office of the Assistant Secretary of Defense for International Security Affairs, by Browne and Shaw Research Corporation. Data from this source cover the year 1964. In all cases, the figures represent regular forces (including conscripts) and do not include paramilitary forces or reserves.

Column 4

Armed Forces per thousand of Population

Sources as for columns 2 and 3.

Column 5

Monetary Cost in Units of National Currency

With the exception of the following countries, data in column 5 are based on AID dollar estimates of defense expenditures converted to national currencies at official rates of exchange: Poland, Czechoslovakia, East Germany, Rumania, Hungary, Bulgaria, and Albania (from *The Military Balance;* see notes to column 3), South Africa, Rhodesia, Congo (Brazzaville), Mauretania, Gabon, Chad, and Central African Republic (based on dollar figures at official rates of exchange in *The Diffusion of Combat Aircraft, Missiles and Their Supporting Technologies* (see notes to column 3).

Column 6

Monetary Cost as Percent of GNE

Estimates by AID.

For all countries with expenditures of over $700 million and for most of the other countries

1966 data were used. For the rest, we used the most recent year available, which in a very few cases went as far back as 1964.

Not included in the table are the following countries with relatively small defense expenditures out of their own resources, or no defense expenditures at all: Aden, Angola, Bahamas, Bahrein, Barbados, Basutoland, Bechuanaland, British Honduras, Brunei, Fiji Islands, Guadaloupe, Iceland, Malta, Martinique, Mauritius, Netherlands Antilles, New Guinea, Papua, Portuguese Guinea, Portuguese Timor, Réunion, Rwanda, Ryukyu Islands, Surinam, Swaziland, Western Samoa, Mozambique.

Strategic Studies (ISS), and in a few cases from the sources indicated in the table notes. Monetary costs, as here defined, are amounts of a specific currency exchanged for defense goods in a particular country. Except for the relatively small amounts of foreign exchange used for imports of defense goods and services, such estimates are in principle expressible only in the currency of the country whose defense program is in question.

Real Costs of National Defense

We want to know not only what was spent on defense but what was bought; i.e., the real quantum of defense goods and services provided. In practice, it is quite impossible to measure and aggregate the physical quantities of the diverse defense goods produced, and the man-hours of different defense services utilized. The only practicable way of express-ing it all in a single figure is in money terms, using the amount of money spent as the measuring stick for the quantity of goods and services in-volved. (Real cost comparisons are usually used to compare changing aggregates over time. Here we are using similar techniques for compari-sons in space.) When intercountry comparisons are involved it is necessary to use a single currency with a known and consistent pur-chasing power. If, for example, the dollar is used to measure the real cost of defense goods and services in different countries, the question we would be trying to answer is: what would be the dollar cost in the U. S. of a selection of economic goods and services equivalent in amount, kind, and quality to the output of defense goods and services in those coun-tries in a given year?

If we knew with respect to foreign defense programs the actual quantity, type, and grade of weapons and clothing consumed by soldiers, the man-hours of defense activity, etc., and if we could decide on the prices of the same number of units of goods and services of comparable type and grade in the U. S., then we could express these totals in dollar prices without any attention to their actual monetary costs in foreign currencies. This physical measurement and summation is not in fact possible, so that it is necessary to proceed on the basis of three separate steps: (1) estimate what is actually spent on defense in foreign countries in their own currencies; (2) calculate the purchasing power of the dollar

relative to each of these currencies in buying similar types of items in the U. S. and in the country being compared; (3) apply these ratios to the foreign expenditure totals.

To calculate the relative purchasing power of currencies (step 2 above) we compare the dollar prices in the U. S. and the foreign currency prices abroad for a fair sample in each country of the same kinds and grades of goods and services we are pricing, and then prepare quantity-weighted averages of the dollar and the foreign prices in question. The ratio of these two average prices will comprise a "purchasing power equivalent" (PPE) exchange rate for the class of goods and services in question. Applying the rate to the local currency costs should in principle give us the dollar price, in the U. S., of the goods and services in question.

One immediate difficulty here is created by the well-known problem of index number construction. If the prices are weighted according to the quantities of each type of goods and services found in the U.S., we obtain different exchange rates than if the prices are weighted according to the quantities found in the other countries in the comparison. One response to this difficulty is to use a geometric average of the results that are derived from the two different weightings. There is much to be said for this, especially when only two countries are being compared. There is, however, also something to be said for retaining the U. S. quantity-weighted rate as the standard when the dollar price is used as a measuring rod for comparisons between a number of industrialized countries.[4]

There are also special difficulties in applying this method to defense activities, because so many defense prices, quantities and qualitative aspects are secret, or cannot be determined. In practice, therefore, in the basic Gilbert-Kravis U. S.—European PPE estimates "apart from Personnel, the quantity relationships and price weights depend upon price-relatives for comparable civilian goods. Hence, the results must be considered approximate, particularly as machinery and vehicle price relations were used for comparisons of major items of military equipment."[5]

In column 1 of the table above we have used the relative movement of the OECD implicit price deflators to update to 1966 the Gilbert-Kravis U. S. price-weighted estimates of defense expenditures in 1955 for the U. K., France, West Germany, Netherlands, Belgium, Italy, Norway, and Denmark. In so doing we applied the personal consump-

[4] "It should be emphasized that the percentage of defense expenditure to gross national product valued at national currencies is the more significant measure of the burden of defense. However, the figures derived from U.S. prices are a significant measure of the real defense contribution measured against a common yardstick," Milton Gilbert and Associates, *Comparative National Products and Price Levels* (OECD, Paris, 1958), p. 51.

[5] Milton Gilbert and Irving B. Kravis, *An International Comparison of National Products and the Purchasing Power of Currencies* (OEEC), p. 36.

tion price deflators to expenditures on military personnel, and operations and maintenance; machinery and equipment price deflators to spending on procurement and R and D; and nonresidential construction price deflators to expenditures on military construction.

With respect to the U.S.S.R. we used a similar sector-by-sector analysis, as explained in DWEI (*loc. cit.*, note 2 above), based on real purchasing power comparisons prepared by Morris Bornstein for the mid-fifties. These have been updated for changes in the sectoral composition of the Soviet program till 1962, and for overall growth in the published defense budget till 1966, but are without adjustments for changes in the type of procurement, or for relative U. S.-U.S.S.R. price changes. Because both the relative price estimates and the price weights are outdated, and also because part of the rise in Soviet published defense expenditure may reflect an increasing share of defense-oriented industrial output and R and D now included within the published defense budget, we have shaved our estimate by 5 percent and are nevertheless concerned that it may still be substantially too high. Defense costs of other Warsaw Pact countries were estimated using PPE rates based on per capita income comparisons. The figure for Mainland China is based on an estimate directly in PPE dollars, and contains an adjustment for presumed growth from the 1964 estimate explained in DWEI. See notes in DWEI and notes to the table below. The very speculative nature of these estimates must be borne in mind.

In most countries, prices have not been studied in sufficient detail to make quantity-weighted price comparisons possible. One of the associates of Milton Gilbert and Irving Kravis in the OEEC—now OECD—Wilfred Beckerman, has, however, developed an ingenious index for the movement of real per capita consumption in the national accounts based on regression equations using data on per capita output, consumption, or use of certain key products or services, such as cement, steel, telephones, radios, meat, road vehicles, and mail. This provides estimates of indicated real per capita consumption, which in turn provides a basis for estimating purchasing power equivalent (PPE) exchange rates in U. S. dollars for the consumption sector in a number of countries.

To be sure, the suitability of these indices for the less developed countries is not fully demonstrated, since the underlying equation from which these PPE rates were primarily derived could often not be applied to these countries in view of the absence of the required data. Nevertheless, in spite of their still experimental character, we regard such PPE rates as likely to be superior to official exchange rates as a measure of the probable real volume of goods and services in the consumption sector.

Official exchange rates may provide a poor indication of the domestic purchasing power of currencies, since they reflect primarily the prices of goods entering international trade which account for only a narrow segment of the total economic life. Moreover, usually official exchange rates are not even free equilibrium rates, since a variety of controls over trade and payments restrict imports as needed to preserve the rates artificially established.

In many countries that are perennially short of foreign exchange and rely heavily on exchange controls, the official exchange rates are substantially overvalued with respect to the types of goods and services in the external sector. However, even a free exchange rate for external transactions would not necessarily equate the purchasing power of different currencies for the type of goods and services produced and consumed locally within their economies. Food and simple clothing, housing, implements, etc., produced and used locally in large quantities, tend to be cheap relative to the cost of goods entering into foreign trade.

Beckerman PPE rates for poorer countries may diverge from official exchange rates in either direction, depending upon whether the extent to which the currency is overvalued (relative to an equilibrium value for the external sector) more than offsets, or fails to offset, the greater cheapness of prices in the domestic as compared to the external sector.

Do PPE rates for the consumption sector offer an appropriate means for deflating military expenditures? Probably not for procurement. While consumer prices (for what foreign consumers can afford) tend to be lower abroad, the U.S. appears to have a comparative advantage in weapons, at least of the more sophisticated varieties; certainly it is a large net exporter of them—and could, no doubt, be so to an even larger degree were it not restrained by prudential and arms control considerations. In fact, in the eight European countries for which we have Gilbert-Kravis sectional PPE rates, the rates for procurement imply that the dollar in the U. S. buys about 27 percent more in weapons on the average than would be obtained in Europe for a dollar's worth of European currencies obtained at official exchange rates. We have now applied a similar adjustment factor in calculating real procurement costs for those other countries where we have some notion of the functional breakdown of the defense total; i.e., we have reduced their cost of procurement in "official rate" dollars by 21 percent.

For most countries, however, we have no indication of the amount spent on procurement. We do know that with few exceptions the amounts are quite small, since, in principle, equipment received as a gift is not supposed to be included. (Defense expenditures estimates shown are, in principle, "out of domestic resources.") The difference between the consumption-based PPE rate and a special discounted

procurement rate applied to this relatively small amount of procurement would not greatly alter the defense totals.

Another controversial question is raised by the valuation set on soldiers' pay and allowances. It has sometimes been suggested that an appropriate valuation of a foreign soldier's pay for PPE purposes is the pay of an average American soldier, since this is what it would actually take to pay for the services of an American soldier. Such a valuation would, however, overlook the crucial condition established in our initial question: What would be the dollar cost in the U. S. of a selection of goods and services equivalent in amount, kind, and quality, etc.? In conformity with this requirement we must compare services of equal productivity.

Productivity as here conceived is not military productivity but productivity in nonmilitary applications. Procurement has been evaluated in the same way, on the basis of prices of civilian machines, trucks, etc., of equal size or performance in civilian use. Viewed simply as an economic resource, an average American soldier is a more productive force than, let us say, an average Albanian soldier. Far more has been invested in his education and training, and he has the capability—with the help of more capital and infrastructure—of immediately producing far more goods and services in civilian occupations.

It seems not inappropriate, therefore, to estimate the real cost of defense personnel (which includes subsistance as well as pay) by deflating the monetary expenditures under this category by a consumption-based PPE rate. This implicitly assumes that national differences in soldiers' compensation are roughly in line with their standards of living and productivity. In this connection it may be of interest to note that an estimate of the probable civilian earning of military manpower in 22 countries, based on average civilian wages in industry, came to within 8 percent of the PPE cost of the personnel sector for these countries.[6] Thus, despite the fact that conscript pay alone is usually below an average industrial wage and also below what would be required to obtain volunteers,[7] the total compensation, in money and in kind, of volunteers plus conscripts approximates to civilian pay—though with considerable national variations, depending on national policies on soldier's pay and allowances.

Government policies also affect the price at which other goods and

[6] DWEI (*loc. cit.*, footnote 2), Table 7, p. 49.

[7] Walter Oi in a paper presented at a meeting of the American Economic Association last year, "The Economic Cost of the Draft," *A.E.R.*, May, 1967, estimated that an all volunteer force of 2.65 million would cost $4 billion more than a mixed force of the same size (p. 61). Our estimates indicated, however, that the U.S. defense forces of 1964-65 would have earned in civilian employment, if employed at an average wage, somewhat less than the total cost of defense "personnel"—including subsistance and allowances. As indicated above these two findings are not inconsistent.

services are transferred to government use. Thus procurement prices will be much higher if the government negotiates on an incentive basis that allows generous profits (much of which is recapturable in taxes) than if it negotiates or renegotiates tightly to restrict profits. Where government arsenals produce the weapons, the prices charged for the output may indeed be quite arbitrary, and may never be fully reflected in defense expenditure totals if the costs of production are reduced by subsidies carried in another part of the budget; e.g., by transferring facilities to defense uses at a price below costs of construction.

Opportunity Cost of Defense

Frederich Von Wieser appears to have been the first economist to approximate the modern concept of opportunity costs as forgone opportunities to produce something else. Thus in 1888 he wrote: "To say that any kind of production involves cost, simply implies that the economic means of production, which could doubtless have been usefully employed in other directions, are either used up in it, or are suspended during it. Costs are production goods when these are devoted to one individual employment, and, on account of their capacity of being otherwise employed, take the shape of outlay, expenditure. The measure for estimating costs is always the productive marginal utility, as it is found on consideration of all the employments economically permissible."[8]

However, as soon as we leave the framework of marginal analysis, and consider the effects of massive shifts in resources to radically different uses (and especially if we abandon the assumptions of perfect competition and factor mobility and admit a certain degree of "jointness" in civilian and military production functions) then we need no longer be bound by Von Wieser's conclusion about equal marginal earnings of productive factors in alternative uses. Under these conditions we must admit the possibility that opportunity costs of resources might diverge considerably from their costs in their present use—specifically that the "civilian opportunity cost," i.e., foregone opportunities to produce more civilian-type goods and services—might be smaller than the cost of defense—as measured, of course, by market value, not utility.

One basic reason for this is that defense not only competes for resources with civilian production but indirectly contributes to it by providing the foundations for internal and international security and confidence without which civilian production would falter and ultimately stop. The extent to which defense activities could be cut, even under general and complete disarmament (GCD), without adversely

[8] *Natural Value* (translated by C. A. Mallock) (Kelley and Millman, 1956), p. 175.

affecting civilian production is not unlimited. An earlier study suggested that under GCD U. S. military requirements to preserve internal stability, plus its required military contribution to a world disarmament and peace-keeping authority, might still come to $17 billion a year, or about 30 percent of its projected defense expenditures before disarmament.[9] This estimate may well be on the high side for the U. S., but an even higher proportion might be required for many other countries which now have only small defense programs and whose central governments lack a well-established constitutional basis.

A similar and more direct contribution to civilian output is provided by certain categories of defense activity which, while absorbing resources that the civilian economy could otherwise have used, at the same time either add to the productivity of resources later applied to the civilian economy, provide some civilian-type goods and services that the civilian economy may use, or replace goods and services that the civilian economy would otherwise have had to provide.

The education of soldiers or their training in civilian-type skills such as truck driving or radio repair contribute to the civilian economy if personnel so educated and trained leave military service and return to civilian activities during their productive years with enhanced productive capacity in civilian employment.

A similar type of contribution would be made by military construction of highways, airfields, harbors, communication networks, etc., which may be available for concurrent or subsequent civilian use. Health expenditures of the armed forces and the construction of family housing illustrate defense expenditures which reduce the amount of goods and services that the civilian economy would otherwise need to provide. A particularly important contribution to the civilian economy may be made by defense R and D. Considerable attention has recently been given to its effect as a competitor of civilian R and D for manpower and facilities. A balanced view must also take into account its role in expanding the supply of R and D personnel and facilities, stimulating bolder use of R and D in civilian industries and improving the technique for management of larger R and D programs—as well, of course, as in obtaining scientific and technical knowledge that may ultimately find civilian application.

In a variety of such ways, therefore, a significant sector of defense activity contributes to civilian economic objectives. The elimination of

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[9] *Economic Impacts of Disarmament*, a Report of the Panel on Economic Impacts of Disarmament, Emile Benoit, Chairman, U. S. Arms Control and Disarmament Agency Publication 2, Economic Series 1, Jan., 1962, Table 3, p. 27. The model is explained in detail in "The Disarmament Model," in *Disarmament and the Economy*, Emile Benoit and Kenneth Boulding, eds. (Harper & Row, 1963), Chap. 2.

such defense activity would add less to civilian output than the amount by which military output was reduced. Hence, the opportunity costs of such military activities may be less than their costs in their present use. How much less, though, is very difficult to estimate.[10]

A further source of possible discrepancy between real and opportunity costs might arise from the costs of transferring resources from defense to nondefense uses. Included in such costs would be the economic disruptions and loss of momentum incidental to the transfer, premature depreciation of specialized equipment and skills, the costs of locational shifts, etc. Such costs would reduce the net economic benefits of the resource transfers and lower the true opportunity costs of keeping the resources in their present use.

The magnitude of these transfer costs is, however, frequently exaggerated in popular discussion.[11] Much depends on the speed of the transfer and the effectiveness of the stabilization and adjustment policies adopted. Any realistic conception of disarmament probably implies resource shifts from defense to nondefense uses of no more than 1 percent of GNP per year, at the most. This is a quite manageable problem for an economy that must increase output by several percent a year anyhow to meet its full employment and welfare objectives. The prospects for effective use of stabilization and adjustment policies, moreover, have been greatly improved in recent years owing to the success of the tax cut of 1964, and the increased public awareness of the need for programs to combat the deterioration of our physical environment, rebuild our cities, and preserve essential amenities. There is also a rapid growth of interest on the part of defense industries in applying high technology and systems analysis capabilities to solving urgent problems of civil life. Thus the transfer costs, in my view, need not appreciably reduce the opportunity costs.

Defense programs may vary considerably in the extent to which they emphasize "civic action" and economic development objectives, and in the degree to which they seek their training, R and D and construction programs to advance civilian economic goals. Relatively little detailed information on this is as yet available from published sources.[12]

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[10] The difficulties are discussed and some hypothetical estimates are attempted in DWEI (op. cit., pp. 48-57). These, however, ignored further problems raised below.

[11] See, e.g., the journalistic treatment of this theme in *Report from Iron Mountain*, author anonymous (Dial Press, 1967), which skillfully plays on popular anxieties. For a more professional examination of the issues, see *Report of the Committee on the Economic Impact of Defense and Disarmament*, Gardner Ackley, Chairman (White House, July, 1965), and the studies referrred to in footnote 9 above, as well as the series of more recent special studies prepared under contract to the Economics Bureau of the Arms Control and Disarmament Agency, described in its list: "Research on Domestic Economic Impact of Disarmament."

[12] Note, however, the very useful survey, *The Peaceful Uses of Military Forces*, by Hugh Hanning (Praeger, 1967). An interesting account of the transfer of civilian technology through one type of military channel is given in Daniel L. Spencer, "An External Military Presence, Technological Transfer and Structural Change," *Kyklos*, 1965, Fasc. 3, pp. 451-74.

Conclusions

In the table below we have listed the defense programs of 120 countries, in the order of estimated real costs as shown in column 1. The priorities and categories are not intended to reflect relative military strength, but are based simply on the quantity of military goods and services provided out of each nation's own resources. Nations that receive large amounts of military assistance may be militarily stronger than their own defense costs would suggest; and, of course, there are many other factors—including nonmaterial factors—that influence military strength. But our focus here is only on military costs, not military effectiveness.

For reasons discussed in the paper, it is believed that these "real cost" estimates, crude and experimental though they still are, provide one of the most useful ways to measure the economic resources utilized in national defense programs. Real cost on a per capita basis in column 2 indicates the cost to the individual citizen—in numbers small enough to be readily grasped.

The estimate of the number of men in the regular military forces in column 3 has the advantage of being a physical quantity not dependent upon the analysis of prices for its interpretation. It is, moreover, an estimate which on an official or unofficial basis is available for most countries. It does not, however, make allowance for troops in the active reserves, and men in border guards, internal security units, and other paramilitary organizations. Nor does it include civilian personnel in defense agencies or employed in defense production. The armed forces per thousand of population (column 4) provides an objective index of at least one significant aspect of the share of a nation's resources committed to defense uses. Column 5 contains the defense expenditure estimates in units of the national currency, and the last column shows such expenditures as a percent of gross national expenditure—indicating the share of national spending directed towards the purchase of defense goods and services.

The total real cost of all defense programs in 1966 is roughly estimated at over $154 billion, or $47 for every human being in the world— an amount in excess of the per capita cash income of a substantial fraction of the human family. Some $107 billion, or about 70 percent of the total, was accounted for by the two superpowers that bear the main burden of the strategic deterrent. The U.S. was spending $322 per capita on defense and the Russian dollar equivalent appears to have been $191. Each of the superpowers maintained over 3 million men in the armed forces—averaging out at 14.5 per thousand of their combined population.

Four other major powers—Mainland China, the U. K., France, and

West Germany—had defense programs in the $4–6 billion category. Only three of them had an independent nuclear weapons capability, and none have as yet possessed a secure deterrent or "assured destruction capability." Only Mainland China had armies at all approximating in size to those of the superpowers; the others had forces in the neighborhood of half a million men apiece. The European members of this group were spending about $80 to $100 per capita on defense and had approximately 8 to 10 men in their defense forces per thousand of population.

A group of 14 secondary powers had defense programs with a combined cost of $15 billion and had a total armed forces of 3.6 million men. Some countries, such as Brazil, India, and Indonesia, spent as little as between $3.00 and $9.00 per capita, whereas the per capita expenditures of more affluent countries in the group, such as Canada and Sweden, resembled those of the European great powers. India is the only country in this group with really large military forces (close to 900,000). Japan's defense program is exceptionally small in relation to her resources.[13] Several countries in this group have the economic and technical resources to develop nuclear weapons in the near future in the absence of an antiproliferation treaty.

Separating the relatively high income regions (North America, Europe—including the U.S.S.R.—Oceania, and Japan) from the rest, one can say that the high income regions had real defense costs of $138 billion or $133 per capita, and maintained military forces of 11 million men, or 10.9 per thousand of their population. The poorer regions had real costs of $15.6 billion and maintained armed forces of 8.5 million men, or 3.8 per thousand of population.

While the costs were generally lower in the poorer countries, the real sacrifice entailed was often high. Interest in the potential economic benefits of disarmament and arms control has hitherto been largely focused on the developed countries and particularly the superpowers. The development opportunities available to developing countries themselves through policies of military restraint and more economically productive use of their defense resources have been relatively neglected.

The opportunity costs of defense programs in developing countries are frequently underrated on the ground that the chief expenditure is for manpower which is in excess supply in any case. It may be overlooked that part of the agricultural unemployment and underemployment is

[13] How this fact may be related to her extraordinary economic growth in the postwar period has been the subject of recent RIEDAC study in Japan: *The Effect of Military Expenditure Upon the Economic Growth of Japan*, by Professors Boulding, Sun, Ichinose, Mine, Ichino, Hisatake, Shibuya, Ishiwate, Nakajima, Fukuchi, and Gleason, edited by Kenneth Boulding and Norman Sun. Enquiries should be addressed to Professor Norman Sun, International Christian Univ., Mitaka, Tokyo, Japan.

seasonal, with labor shortages at times of sowing and harvesting. Operations and maintenance requirements, even where equipment is received free of charge, may also absorb a larger share of available skilled labor, foreign exchange, and managerial capacities than recognized. Moreover, the food and clothing supplied soldiers may incorporate a considerable volume of transportation and administrative services and so cost considerably more than the food and clothing they would have obtained for themselves on the farm.

A realistic assessment of what a curtailment or restructuring of defense programs might contribute to higher living standards in both developed and underdeveloped countries must, however, await a more detailed and precise knowledge than we now have of the actual economic contents of the world's defense programs; i.e., what they absorb from and what they contribute to the civilian economies of their own societies. Defense planners should bear in mind that from an opportunity cost viewpoint the design of defense programs may be as important as their size, and that improvements in design may in some cases enhance national and international security while reducing net economic burdens or even contributing importantly to economic objectives. Economic implications probably deserve far more explicit and expert consideration than they get in most countries' defense planning, and both defense planners and economic planners would benefit greatly by improved communications, especially in the developing countries.

In emphasizing, as we have in this paper, factors frequently overlooked that may limit the potential economic benefits of disarmament, we certainly do not mean to deny their importance. The real benefits would depend, of course, on the social utility and productiveness of the new uses to which the released defense resources were shifted. There is nothing inherent in the disarmament process itself that necessarily requires or implies a more liberal attitude toward social transfers, either within or between nations. Certainly there is no basis whatever for the assumption, often implicitly or explicitly made in popular discussion, that a great increase in such transfers either internally or internationally would be required to make the reemployment of the released resources possible.

On the other hand, there have been at least limited and general political commitments by the governments of the highly industrialized countries suggesting that part of the released resources would in fact be utilized for world economic development. Indeed, some of the resources likely to be released from defense uses would be well suited for this purpose. Moreover, it seems a reasonable expectation that something analogous to windfall gains might be more liberally shared than regular increments to incomes. Certainly it would be easier for developing

countries to apply windfall receipts to productive forms of investment than to raise the rate of saving out of normal income.

With respect to productivity, it may be noted that defense forces are generally above the civilian average in education and technical skills, and are concentrated in the most productive age groups. Moreover, defense industry, while poorly adapted for routine types of civilian production and marketing, is high-performance-oriented and exceptionally well qualified for systems analysis and systems engineering application in advanced, high-technology industries, which have the brightest prospect for public usefulness and dynamic growth.

Thus if wise and effective transfer policies are adopted, the long-run civilian benefits of applying defense resources to civilian industries could be far in excess of what might be judged from the price set on these resources in defense uses. One poorly understood factor that is relevant here is that the value of defense output is determined essentially by costs, and these costs are restrained somewhat by the fact that a considerable part of the output is priced under monopsonistic conditions. Improvement in the product does not raise its price except to the extent that this involves higher costs. The extent of the technological progress achieved by major breakthroughs, such as were represented by the Minuteman and Polaris systems, is by no means fully reflected in the defense expenditure totals, staggering as these may appear. A comparable breakthrough in a civilian product (for example, a new plastic building material with the weight of magnesium but the strength, rigidity, and cost of steel) would involve an enormous increase in values registered through market processes and the widespread adoption of the new product all over the world—which is precisely what governments achieving weapons breakthroughs seek to prevent from happening.

In many developing economies, disarmament would not, I believe, involve any drastic reduction of existing defense forces, since these forces will continue to be needed for preserving internal stability and might become politically dangerous if demobilized. Rather, the strengthening of the international order would make possible a gradual reorientation of these defense programs, giving greater emphasis to civic action, economic development goals—with a corresponding enlargement of the professional role of the military establishment.

Thus the transition from a national defense system to a world security system could have benefits going considerably beyond those hinged directly to the reductions in national defense programs. Indeed, it is only after the possibility of war has been effectively exorcised in this way that full international economic cooperation consistent with our increasingly interdependent technology and cultural world will become a practical possibility.

ECONOMIC SANCTIONS AND REWARDS IN SUPPORT OF ARMS CONTROL AGREEMENTS*

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It has often been suggested that economic sanctions and/or rewards can play a useful role in support of arms control measures of various kinds, ranging from formal disarmament treaties to informal agreements about limitations on armaments. For example, the threat of sanctions might deter countries from violating arms control agreements; sanctions or the threat of sanctions might bring about the elimination of violations which are committed and detected; and sanctions would punish the violating nation. Economic rewards, in turn, might be offered to secure the agreement, or continued adherence, of countries to arms control measures.

The purpose of this paper is to analyze the potential usefulness of economic sanctions and rewards. The first section deals with the nature and problems of economic sanctions. The second section examines as a case study the recent application of economic sanctions to Rhodesia. The final section considers the use of economic rewards.

I. *Economic Sanctions*

The aim of economic sanctions is to deprive the country (or group of countries) subject to them of goods and services by interfering with international trade and capital movements. Economic sanctions may take a number of forms. In the discussion which follows, the "subject" of a sanction is the country against which the sanction is imposed. "Object" of a sanction refers to the goods or activities covered by the sanction. "Participants" in a sanction refers to the countries applying the sanction, while "nonparticipants" describes third countries which neither are subject to the sanction nor participate in it.

Embargo on Exports. Probably the most common technique, an export embargo prohibits exports from the participants to the subject, both directly and—insofar as it can be enforced—indirectly through one or more nonparticipants. The prohibition on exports may be partial or complete. It is usually enforced by a system of export licenses and supporting measures, such as destination and transit controls, intended to

assure that exports go to their stated destinations and are not reshipped to the subject.

Embargo on Imports. An embargo on imports from the subject into the participants attempts to reduce the subject's foreign exchange earnings and thus its ability to purchase goods. It may also be intended to cause unemployment in the subject (initially in its export industries and subsequently throughout the economy as a whole, in a magnitude determined by the foreign trade multiplier). Despite compensatory finance and efforts to reallocate resources, rigidities in the subject's economy are likely to prevent the complete reallocation of factors of production formerly employed in its export sector.

Financial Controls. These are concerned, not with the actual physical movement and availability of goods, but rather with the means of financing their movement. These controls involve restrictions on payments to or from the subject; suspension of any loans, credits, or grants to the subject; and blocking of its gold and foreign exchange holdings and other assets abroad. By themselves, financial controls are inferior to trade controls, because they attempt to control the means of payment rather than the goods themselves. Commonly, however, financial controls are used to reinforce trade controls; for example, to prevent the subject from drawing upon foreign exchange balances in the participants' banks to finance purchases of embargoed goods from nonparticipants.

Transportation and Communication Controls. These comprise restrictions on shipping services; use of aircraft, railways, and canals; and radio, postal, and telegraphic communications with the subject. Shipping controls, for instance, include denying shipping services to the subject by prohibiting the sale or charter of vessels and the carriage of embargoed goods in other vessels. These controls may be applied to the vessels of nonparticipating countries by denying them the use of port, refueling, and repair facilities if they carry (or have in the past carried) embargoed goods.

Sequestration of Property. This measure involves the seizure of property of the subject in participating countries and is closely related to the freezing of its financial assets.

Preemptive Purchasing. This measure consists of purchases of goods by the participants in nonparticipant countries, in order to deny these goods to the subject of an embargo. Preemptive purchasing may be accomplished by purchase agreements, or it may involve simply bidding the goods away from the subject.

Other Measures. In addition, there are a number of other possible but somewhat less direct measures which the participants may use against

the subject. For example, they may attempt to worsen the subject's terms of trade by various devices, including tariffs and quotas. They may try to disrupt the subject's markets or vary their trade with the subject in an unpredictable manner.

Application of sanctions involves a number of problems, which will be discussed briefly in the illustrative case of an export embargo. However, the analysis generally applies as well to the other sanctions, *mutatis mutandis*.

Vulnerability of the Subject. The vulnerability of a potential subject to an export embargo depends upon: the relative importance to its economy of the goods which are the object of the embargo; the ability of the subject to obtain the embargoed goods either by importing them from its allies (if any) or nonparticipants or by reallocating resources in order to produce them at home; and its ability to do without the embargoed goods.

At first glance, it might seem that a country whose imports are comparatively large in relation to its national product is more vulnerable to an export embargo. However, it is the composition of imports and their role in the economy rather than the ratio of total imports to GNP which is significant. To take the example most commonly cited, a country dependent on imported petroleum for most of its fuel and energy requirements is very vulnerable to a petroleum embargo even if petroleum imports are comparatively small in relation to GNP. On the other hand, a country with a fairly high ratio of imports to GNP may be relatively invulnerable to an embargo if it produces most of its food, has a comparatively full array of raw materials, and satisfies much of its needs for manufactured products.

Scope of the Embargo. The prohibition on exports from the participants to the subject may be either partial or complete. A complete embargo may appear simpler than a partial one, because the irksome problem of determining exceptions is avoided. However, there are several cogent reasons for considering a selective embargo. First, a complete embargo which includes goods not very important to the subject may not have any greater persuasive effect on the subject than a carefully selective embargo limited to critical imports. Second, a selective embargo permits a graduated response related to the severity of the offense and to the extent to which the subject's offending behavior is modified. Third, a selective embargo may be designed to hurt the subject without undue or disproportionate harm to the participants, by selecting those goods which are more vital as imports to the subject than as exports to the participants.

Participation in the Embargo. The embargo will be ineffective insofar

as the subject is able to secure embargoed goods from nonparticipants either directly from their own production or indirectly through non-participants' reexport to the subject of embargoed goods which they have imported from the participants. Thus, it is important to include in the embargo all countries which are or could be major suppliers of the embargoed goods, on the one hand, and to assure by destination and transit controls that the embargo is not circumvented by continued im- , ports through third countries.

The willingness of countries to participate in an embargo against a violator of an arms control agreement is in part a political question, involving their view of the agreement and of the violation. In part, it is an economic question involving the cost to a participating country from reduced exports to, and presumably reduced imports from, the subject country. It is clear that the cost of participating in an embargo will be greater for some nations than others, depending on the extent and composition of their economic relations with the subject. Since partici-pation is undertaken in the international interest, but at national ex-pense, the nations participating at great cost to themselves may seek compensatory assistance from other participants not so severely affected. Indeed, seriously affected nations may require such assistance as a condition of participation in the embargo. Thus, the cost or burden of participation must be redistributed by such devices as loans or grants, in cash or in kind, to deal with the balance-of-payments problems arising from the interruption of trade and capital movements with the subject; the provision of alternative markets for goods formerly ex-ported to the subject and alternative sources of supply for goods for-merly imported from the subject; and perhaps capital and technical assistance for the reallocation of production in severely affected coun-tries.

To summarize, in the illustrative case of an export embargo the sanc-tion will be effective when it is possible—unilaterally or through multi-lateral participation with appropriate redistribution of the burden—to deny to the subject imports which are critical to the operation of the economy and which cannot be replaced by domestic production or imports from other sources (nonparticipants). These conditions are not likely to apply to any of the major world military powers, and indeed not to most of the second- and third-class military powers. These con-ditions may apply to some of the smaller, less developed countries with more specialized economies which are highly dependent on certain imports (and exports). Even in such cases, however, it is not clear that sanctions would be effective, because the subject's vulnerability is not great enough and/or because participation in the embargo may be incomplete. This may be illustrated by the case of Rhodesia.

II. *A Rhodesian Case Study*

Although economic sanctions against Rhodesia were not levied in response to the violation of an arms control agreement, the Rhodesian case is of interest to the present discussion for several reasons. First, it is the most recent attempt to use international economic sanctions. Second, it is the first time in its history that the United Nations has voted for mandatory sanctions. The only similar previous action was the League of Nations sanctions against Italy in 1935 in response to the invasion of Ethiopia. Third, the circumstances of the Rhodesian case seemed to indicate that sanctions might be successful. The specialized structure of the raw-material-exporting Rhodesian economy would appear to make it vulnerable to sanctions. There was widespread (though not universal) condemnation of the Rhodesian actions leading to sanctions. And sanctions were applied selectively to make the burden upon Rhodesia greater than that upon the participants.[1]

Sanctions were imposed against Rhodesia following the Ian Smith government's Unilateral Declaration of Independence (UDI) when Great Britain was unwilling to approve independence without agreement about transition to majority (black) rule. The aim of the sanctions was to induce the Smith government to agree to a plan for transition to majority rule acceptable to Britain. When UDI was announced on November 11, 1965, Britain declared the action illegal and instituted partial financial and economic sanctions against Rhodesia. On November 12, the United Nations Security Council condemned the Smith government's action, and on November 20 it passed a resolution urging (but not directing) all nations to suspend their economic relations with Rhodesia, particularly shipments of arms and petroleum products. On December 1, Britain imposed further restrictions on trade with Rhodesia, prohibiting 95 percent of the value of Rhodesia's normal exports to the United Kingdom, and on December 3 Britain took control of the Rhodesian Central Bank's assets in banks abroad. During the period from November, 1965, to December, 1966, the British government continued negotiations with the Smith government but was unsuccessful in reaching an agreement. On December 16, 1966, in response to a British proposal, the UN Security Council called for mandatory sanctions against Rhodesia. These sanctions now consist of four types.

Embargo on Selected Exports to Rhodesia. The selective embargo includes exports of petroleum products, arms, ammunition, aircraft,

[1] For a brief account of Rhodesian, British, United Nations, and U. S. actions, see "Southern Rhodesia and the United Nations: The U. S. Position," *Department of State Bulletin*, Mar. 6, 1967, pp. 366–77. For a sociological analysis of sanctions against Rhodesia, see Johan Galtung, "On the Effects of International Economic Sanctions, With Examples from the Case of Rhodesia," *World Politics*, Apr., 1967, pp. 378–416.

motor vehicles, and equipment and materials for the manufacture and maintenance of aircraft and motor vehicles. The petroleum embargo was expected to weaken, if not cripple, the Rhodesian economy, as imported petroleum accounted for 27 percent of Rhodesia's energy supplies in 1965, with 63 percent coming from domestic coal and 10 percent from domestic hydroelectric power.[2]

Embargo on Imports of Rhodesia's Major Exports. The embargo applies to nine Rhodesian exports which accounted for 61.5 percent of the total value of exports in 1964. These exports and their percentage shares in total exports in 1964 are as follows: tobacco, 34.9; asbestos, 8.5; copper, 4.1; pig iron, 3.7; chromium, 2.1; sugar, 3.0; hides, skins, and leather, 0.8; and iron ore, 0.3.[3] The embargo was expected to cut Rhodesia's foreign exchange earnings and thus its ability to import, and to cause unsold inventories of export commodities to rise, leading to curtailment of production and employment in the export sector and subsequently in the rest of the economy.

Financial Controls. Britain responded to UDI by immediately suspending all aid to Rhodesia, forbidding the export of British capital to Rhodesia, and removing Rhodesia from the sterling area and from Commonwealth trade preference arrangements. The United States suspended action on applications for U.S. government loans and investment guarantees for Rhodesia, and other capital-exporting nations have taken similar measures.

Transportation Controls. The United Nations resolution on mandatory sanctions included a prohibition on the transport of embargoed goods.

In addition to Britain, over 70 nations have reported to the UN that they are participating in the sanctions against Rhodesia. This number includes the United States, Canada, virtually all of the West European countries, Japan, the Soviet Union and the East European countries, and much of Latin America, Asia, and Africa. There are, however, two significant pairs of nonparticipants—all neighbors of Rhodesia. One pair consists of Rhodesia's former partners in the Federation of Rhodesia and Nyasaland: Zambia (formerly Northern Rhodesia) and Malawi (formerly Nyasaland). The other pair is the Union of South Africa and the Portuguese territory of Mozambique.

The economies of both Zambia and Malawi are too closely linked to that of Rhodesia to enable them to participate in sanctions against Rhodesia without serious damage to their own economies. In fact, the

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[2] United Nations Special Committee on the Situation With Regard to the Implementation of the Declaration on the Granting of Independence to Colonial Countries and Peoples, *Report* (A/6300/Add. 1), 7 Oct. 1966, Chap. III, Part I, p. 65. (This publication is hereafter cited as UN, *Report.*)

[3] United Nations Statistical Office, *Yearbook of International Trade Statistics 1965* (New York, 1967), pp. 647–48.

scope of the embargo on Rhodesian exports was chosen so as to exclude, insofar as possible, commodities for which these two countries are dependent on Rhodesia. In 1964, Zambia's trade with Rhodesia accounted for 30.8 percent of Rhodesia's exports and 5.4 percent of Rhodesia's imports, and 39.4 percent of Zambia's imports and 4.1 percent of Zambia's exports. Rhodesian exports of electric energy and coal were vital to Zambia, whose copper industry, the mainstay of the economy, depended on Rhodesia for these commodities as well as railway access to the ocean. Thus, although Zambia's full participation in sanctions against Rhodesia would have seriously damaged the Rhodesian economy, particularly its nonagricultural sector, it would also have crippled the Zambian economy. In 1964, Malawi obtained 39.1 percent of its imports from Rhodesia and sold 11.4 percent of its exports to that country, while trade with Malawi accounted for only 4.7 percent of Rhodesia's exports and 1.5 percent of its imports. Thus, Malawi's dependence on Rhodesian sugar and meat prevented it from participating in the embargo against these Rhodesian exports.[4]

Key leaks in the sanctions against Rhodesia, however, are through South Africa and Portuguese Mozambique. South Africa had publicly proclaimed its sympathy with the Smith regime and its willingness to recognize it in the event of UDI. Nevertheless, Britain apparently expected that South Africa would remain "neutral" in regard to sanctions against Rhodesia, by not increasing its trade with Rhodesia to offset or circumvent sanctions. In fact, South Africa is following a policy of not participating in any form of sanction and of maintaining "normal trade relations" with Rhodesia, which are understood to consist of attempting to sell Rhodesia whatever it can and to provide an outlet for Rhodesian exports. Thus, in 1966 South African exports to the rest of Africa were 32 percent greater and imports from that area 18 percent greater than in 1965. These figures include transit trade, as well as exports of national origin and imports for national consumption. Data on South Africa's transit trade and the geographical distribution of trade with the rest of Africa have not been disclosed since mid-1965, but it seems clear that the increase in South African trade is attributable primarily to greater trade with Rhodesia as a result of sanctions.[5]

Although Mozambique is not an important trading partner of Rhodesia, it is Rhodesia's traditional route to the sea, through which Rhodesia obtains most of its petroleum and other imports and through

[4] *Ibid.*, pp. 476, 649, and 863; UN, *Report*, Chap. III, Part II, pp. 110–13; and "Malawi Appeals on U. N. Sanctions," *New York Times*, Feb. 17, 1967, p. 14.

[5] United Nations Special Committee on the Situation With Regard to the Implementation of the Declaration on the Granting of Independence to Colonial Countries and Peoples, *Question of Southern Rhodesia: Working Paper Prepared by the Secretariat; Addendum* (A/AC. 109/L. 393/Add. 1), May 15, 1967, p. 12. (This publication is hereafter cited as UN, *Question . . . Addendum.*)

which its tobacco and mineral exports are shipped. Portugal has announced that it will not participate in sanctions against Rhodesia nor "interfere with private transport to and from landlocked countries."[6]

The evidence, after a year of "voluntary" sanctions and another year of "mandatory" sanctions, suggests that Rhodesia has managed to withstand sanctions as a result of South African and Portuguese assistance in circumventing sanctions, on the one hand, and Rhodesia's ability to adjust to the impact of sanctions insofar as they have been effective. The Smith government has claimed that GNP in 1966 was less than 5 percent below the 1965 level (although it is not clear to what extent this figure is adjusted for price changes) and that European employment was about the same as in 1965 and African employment higher. However, it is conceded that both exports and imports fell 27 percent from the 1965 level.[7]

Consumption of petroleum products is officially admitted to have been cut to two-thirds the presanction level (and may actually be lower), but rationing has distributed the reduced supplies so as to avoid disruption of public or private transportation, and additional quantities of gasoline are available "off-ration" at higher prices.[8] Import controls have been used to curtail imports of "nonessential" goods and to stimulate local production of import substitutes.

The situation is much more acute in regard to tobacco exports, which accounted for a third of Rhodesia's total exports before UDI, and more than half of which went to the United Kingdom. The 1965–66 tobacco crop was 250 million pounds, but only 120 million pounds could be sold in the government's secret auction, with the remainder purchased by the government at the support price for stockpiling. The 1966–67 crop was about 200 million pounds, with about half being stockpiled. The target crop for 1967–68 is only 132 million pounds, and farmers are being urged, with the aid of price supports, to shift from tobacco to wheat and maize.[9] Rhodesian mineral exports have also suffered from the sanctions, although it is reported that considerable amounts are reaching the world market (including traditional customers) through Mozambique and South Africa, with false certificates of origin. According to one estimate, in 1967 exports have been, in relation to the presanctions level, as follows: copper and asbestos, 100 percent; iron ore, 50 percent; and chromium, 33 percent.[10]

[6] UN, *Report*, Chap. III, Part II, p. 162.

[7] UN, *Question . . . Addendum*, pp. 9–11.

[8] *Ibid.*, p. 18.

[9] *Ibid.*, pp. 13–14, and "Rhodesia: Effect of Sanctions on Tobacco Industry," *African Research Bulletin*, June 30, 1967, p. 755.

[10] "The Sanctions Busters," *Sunday Times* (London), Aug. 27, 1967, p. 9, which also gives details of the mechanisms used to evade sanctions. See, also, "British Trade with Rhodesia Continues Despite Sanctions," *New York Times*, Sept. 29, 1967, p. 6.

Of the participants in the sanctions, the greatest burden has fallen on Zambia and Britain. Zambia has tried to reduce its dependence on Rhodesia by finding new sources of imports and new outlets for exports. In place of petroleum formerly imported through Rhodesia, Zambia now obtains supplies by air at greater cost. It has replaced Rhodesian consumer goods with supplies from other sources, foreign and domestic. Zambia has begun to develop domestic mines to replace Rhodesian coal, and it is exporting copper by new rail, road, and air routes to the West and East African coasts to avoid shipping it through Rhodesia. As a result of these measures, Zambian exports to Rhodesia fell from £ 5.4 million in 1965 to £ 2.5 million in 1966, and imports from £ 33.5 million to £ 23.1 million.[11] These adjustments, though incomplete, have been painful and costly for Zambia, which claimed that the first two months of sanctions alone had cost it $90 million.[12]

The cost of the sanctions to Britain has taken several forms. The reduction in trade with Rhodesia is not very important, considering the magnitude of Britain's total exports and imports and the availability from other sources of the embargoed Rhodesian exports. More serious have been the cost of aid to Zambia and the assumption of Rhodesia's obligations to the International Bank for Reconstruction and Development. Through June 30, 1967, the United Kingdom had granted Zambia aid amounting to £ 13.8 million to cover the cost of the petroleum airlift, the development of alternative land transportation routes, the opening of new coal fields, and connections to a new power station to reduce dependence on electricity from Rhodesia.[13] In 1966 alone, Britain paid £1,294,000 in interest and principal on IBRD loans to Rhodesia for which it had served as guarantor.[14]

By way of summary appraisal, one must conclude that sanctions against Rhodesia have not been successful in achieving their objective. The British government's expectation, supposedly resting on the basis of "expert advice" that "economic and financial sanctions might well bring the rebellion to an end in a matter of weeks rather than months"[15] has proved ill-founded. This view apparently underestimated both the extent of aid from South Africa and Portuguese Mozambique and Rhodesia's ability to adjust to the sanctions insofar as they were effective. On the other hand, it is possible that sanctions were not really

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[11] "Zambia: Effects of UDI on Economy," *African Research Bulletin*, May 31, 1967, p. 736; "Zambia Cutting Trade Dependence on Rhodesia," *New York Times*, Aug. 17, 1966, p. 2; and UN, *Question . . . Addendum*, p. 12.

[12] United Nations Special Committee on the Situation With Regard to the Implementation of the Declaration on the Granting of Independence to Colonial Countries and Peoples, *Question of Southern Rhodesia: Working Paper Prepared by the Secretariat* (A/AC.109/L.393), Apr. 7, 1967, p. 61.

[13] "Britain and Zambia Sign Aid Accord," *New York Times*, Feb. 2, 1967, p. 11.

[14] UN, *Report*, Chap. III, Part II, p. 159.

[15] "Sanctions Slow, London Says," *New York Times*, Apr. 11, 1966, p. 8.

expected to bring about a fundamental change in the Smith regime's policy but rather were adopted simply as the strongest measure available, after military action had been ruled out, and as a way of expressing disapproval of UDI and punishing Rhodesia for it.[16] In any case, sanctions against Rhodesia have not yet accomplished their stated aim, nor is it evident that they are likely to do so in the near future. Instead, the Rhodesian case illustrates the risks of overoptimism regarding the vulnerability of the subject and the universality of participation in sanctions. Much the same lesson was provided by League of Nations sanctions against Italy: the conditions for successful application of economic sanctions are not easily fulfilled.

III. *Economic Rewards*

If sanctions are not a very promising means of securing adherence to arms control measures, are economic rewards likely to be effective? One category of possible economic incentives is trade concessions, including reductions in tariff restrictions, such as the extension of most-favored-nation treatment if it is not already accorded, and affiliation with regional trade blocs; higher import quotas for goods from the country to be rewarded; and favorable trade agreements with it. Another category comprises aid of various types, including loans and grants, in cash and in kind (e.g., surplus food), and technical assistance.

A specific example related to arms control is the offer of aid for non-military applications of military technology. Thus, the United States draft treaty on nonproliferation of nuclear weapons offers nonnuclear signatories eschewing nuclear weapons, assistance in the development of nuclear energy for peaceful purposes and nuclear explosive services for peaceful purposes at minimum cost without any charge for research and development.

Economic incentives may seem appealing because, once accepted, they provide a potential means for economic sanctions, through the threatened or actual withdrawal of the benefits accorded. However, it is doubtful that such economic incentives can be very powerful in securing adherence to arms control measures. States are unwilling to sacrifice what they regard as the requirements of national security in order to obtain trade or aid concessions. In their policy-makers' social welfare function, national security carries greater weight than the larger national income, higher rate of growth, or more satisfactory balance-of-payments situation which economic incentives for arms control measures might offer.

Thus, for instance, the single most important obstacle blocking

[16] Thus, sanctions may have been intended to serve an "expressive" rather than an "instrumental" function. See Galtung, *op. cit.*, pp. 411–12.

agreement on a nuclear nonproliferation treaty is reported to be the insistence of nonnuclear countries, including India, Italy, and Brazil, on guarantees, by the nuclear power signatories, of protection against attack from nuclear nonsignatories. This issue is considered to be more critical than either inspection procedures for enforcement or aid in the peaceful use of nuclear energy.[17]

As this example illustrates, the potential of economic incentives, like that of economic sanctions, for securing adherence to arms control measures is limited. The reason in both cases is that nations believe, as a well-known economist once put it, that "defense . . . is of much more importance than opulence. . . ."[18]

[17] "Atom Pact Draft Gets Slight Support," *New York Times*, Sept. 3, 1967, p. 14.

[18] Adam Smith, *The Wealth of Nations*, Book IV, Chap. II (Cannan Modern Library ed.), p. 431.

ARMS AND THE AMERICAN ECONOMY: A DOMESTIC CONVERGENCE HYPOTHESIS

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The close, continuing relationship between the military establishment and the major companies serving the military market is changing the nature of both the public sector of the American economy and a large branch of American industry. To a substantial degree, the government is taking on the traditional role of the private entrepreneur while the companies are becoming less like other corporations and acquiring much of the characteristics of a government agency or arsenal. In a sense, the close, continuing relationship between the Department of Defense and its major suppliers is resulting in a convergence between the two, which is blurring and reducing much of the distinction between public and private activities in an important branch of the American economy.

This domestic convergence hypothesis needs to be distinguished from other analyses of the interaction between government and private industry. The analysis presented here does not evoke the conspiratorial flavor of so much of the discussions of a "military-industrial complex." Also, it is narrower than the contention of Professor Galbraith that modern large corporations are becoming part of the governmental administrative complex.[1] To the contrary, an attempt is made below to demonstrate that the convergence phenomenon here described is limited to one branch of American industry. It will also be shown that the government-oriented corporation is becoming measurably different from large American business firms that primarily cater to industrial and consumer markets.

The Public Assumption of Private Decision Making

In its long-term dealings with its major suppliers, the Department of Defense gradually has taken over directly or indirectly many of the decision-making functions which are normally the prerogatives of business management. Three aspects of this public assumption of, or active participation in, private decision making can be identified: the choice of which products the firm is to produce, the source of capital funds, and

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[1] "Increasingly it will be recognized that the mature corporation, as it develops, becomes part of the larger administrative complex associated with the state. In time the line between the two will disappear." John Kenneth Galbraith, *The New Industrial State* (Houghton Mifflin, 1967), p. 393.

the internal operation of the firm.[2] This government involvement in private industry arises in the case of the unique and large-scale nature of military weapon-system and related procurement. It hardly characterizes the purchases of standard items by civilian government agencies through fixed-price contracts awarded via sealed-bid competition.

By awarding massive contracts for research and development ($6.3 billion in the fiscal year 1966), the Department of Defense has come to strongly influence or determine which new products its contractors will design and produce. In the commercial economy, in contrast, research and development costs normally are only recovered to the extent that they result in the sale of profitable products. Hence, the decisions to embark upon a product research and development program are made by the sellers, who bear the risk of not recovering their technological investment. Of course, defense contractors may and do sponsor and fund some of their own R and D effort. However, the bulk of their R and D is performed under government contract (over 90 percent of the aerospace industry's R and D in 1964 was so funded).[3] Much, if not most, of the remainder is charged as allowable overhead on their government contracts, having met the approval of military reviewing officials. In good measure, military product design and development is not an intermediate good but an end product which the contractor produces for sale to the government under contract awarded before the R and D is undertaken.

The military establishment also uses its vast financial resources to supply the bulk of the plant and equipment used by its major contractors and also a major part of the working capital that they require. A survey of 13 of the largest defense contractors covering the years 1957–61 revealed that the cost of government-supplied property was $1,539 million, while gross company property reported on balance sheets was $1,463 million.[4] During the Vietnam war, Defense Department expenditures for additional plant and equipment to be supplied to its contractors have risen sharply, from $56 million in the fiscal year 1965 to an estimated $330 million in 1967.[5]

In addition, during 1966, approximately $4.7 billion of outstanding "progress" payments were held by defense contractors. Some individual defense firms reported that such government-supplied working capital

[2] Another and perhaps more minor indication of the extent to which these companies have become dependent on the military establishment is the Pentagon practice of reimbursing them for the state and local income taxes which they pay on their profits from military work (Armed Services Procurement Regulation, Section 15-205.41).

[3] National Science Foundation, *Basic Research, Applied Research, and Development in Industry, 1964* (1966), p. 73.

[4] Stanford Research Institute, *The Industry-Government Aerospace Relationship*, Vol. 11 (Menlo Park, Calif., 1963), p. 119.

[5] House of Representatives, Committee on Appropriations, *Department of Defense Appropriations for 1968*, Part 4, 1967, p. 401.

exceeded their total book assets.[6] Military procurement regulations
provide specific disincentives for the use of private working capital.
Progress payments equal to 70 percent of the costs incurred on govern-
ment contracts generally are provided without interest charge to the
contractor (Section E-503 of the Armed Services Procurement
Regulation). In contrast, should these companies decide to rely on
private sources for working capital, their interest payments may not
be charged to the contract and, hence, must come out of their profits
(Section 15-205.17). Presumably, this arrangement results in smaller
total cost to the government because of the lower interest rates paid by
the U.S. Treasury on the funds that it borrows. However, the result also
is to increase the extent to which public rather than private capital
finances the operations of defense contractors. Hence, the financial
stake that the military establishment has in the performance of its
contractors is increased further.

Another and perhaps the most pervasive way in which the Depart-
ment of Defense assumes the management decision-making functions
of its contractors is through the procurement legislation and regulations
governing the contracts it awards. The Armed Services Procurement
Regulation requires military suppliers to accept on a "take it or leave
it" basis many standard clauses in government contracts which give
the military contracting and surveillance officers numerous powers over
the internal operations of these companies. These unilaterally deter-
mined grants of authority vary from matters of substance to items so
minor that they border on the ludicrous. It should be realized that these
restrictions generally have been imposed to prevent specific abuses
which may arise; however, the cumulative and long-term impacts on
company initiative and entrepreneurship are rarely considered. These
restrictions represent a form of government regulation via its monop-
sonistic power rather than through the traditional independent regula-
tory agency.

The authority given to the customer includes power to review and
veto decisions as to which activities to perform in-house (Section 3-900)
and which to subcontract (Sections 1-800 and 1-707), which firms to use
as subcontractors (Section 7-203.8), which products to buy domestically
rather than to import (Section 6-100), what internal financial reporting
systems to establish (Section 3-800), what type of industrial engineering
and planning system to utilize (Section 1-1700), what minimum as well
as average wage rates to pay (Section 12-601), how much overtime work
to authorize (Section 12-102.3), and so forth.

An example of the more minor matters covered in the detailed and

[6] Cf. annual reports of McDonnell Aircraft Corporation for recent years.

voluminous military procurement regulations is the prescription that the safety rules followed in the offices and factories of the contractors must be consistent with the latest edition of the Corps of Engineers safety manual (Section 7-600).

The whole philosophy of close government review of the internal operations of its contractors is so deeply imbedded that insertion of statements such as the following in the Armed Services Procurement Regulation evoke no public or industry reaction: "Although the Government does not expect to participate in every management decision, it may reserve the right to review the contractor's management efforts, including the proposed make-or-buy program." (Section 3-902.1.)

Of course, many have contended that cost-plus contracting by the military establishment has shifted much of the risk-bearing from the industrial seller to the governmental buyer. The use of fixed price contracts has increased in recent years. However, a major share of defense contracts still is on a cost reimbursement basis. So long as this remains the case, the government determines which items of cost are "allowable" as charges to the contract and hence, for most practical purposes, which activities and which items of expenditure the company can undertake (disallowed costs directly reduce company profits).

The defense industry survey mentioned earlier reported the relative importance of the various types of unallowable costs to 12 major defense contractors, as follows:[7]

Expense Category	Percent of Total Unallowable Costs
Interest expense	34
Advertising and selling	22
Research and development	16
Management supplementary compensation	7
Excess amortization of emergency facilities	6
Donations, contributions, dues, and subscriptions	5
Entertainment and travel in excess of government daily allowance	5
Employee premium pay	4
Legal and professional services	1
Total	100

It needs to be kept in mind that the industry-military relationship is a dynamic one. Numerous changes are made in military procurement regulations in the course of a year, many of them extending the role of the military in the internal operations of the contractors. The list of unallowable costs of defense contractors was lengthened during the years 1953–61 by the following eleven items:[8]

[7] Stanford Research Institute, *op. cit.*, p. 154.
[8] *Ibid.*, p. 155.

Cost Item	Date First Reported Unallowable by 15 Companies
Technical displays	1953
Unapproved overtime	1955
Business conferences	1956
Bid and proposal expense	1956
Employee moving expense	1958
Foreign office expense	1958
Operation of executive airplanes	1959
New York purchase tax	1959
Personal property tax	1960
Patents expense	1961
Public relations	1961

A review of revisions in the Armed Services Procurement Regulation in more recent years confirms the continuation of this pattern of increased governmental involvement in the internal decision making of the contractors. The following is a sample of such changes during the period April, 1966–October, 1967.

1. In contracts for aircraft tires, tubes, and recapping, the contractor must purchase an amount of rubber from the government's stockpile equal to at least 50 percent of the value of the contract (Section 1-323 of the Regulation). Such tie-in contracts, if made between two private firms, would run afoul of the antitrust laws.

2. Similar but less restrictive requirements must be met in the case of military contractors providing aluminum products to the military (Section 1-327.1).

3. Military contractors must buy all of their jewel bearings from the government-owned Turtle Mountain Bearing Plant at Rolla, North Dakota (Section 1-315).

4. In deciding whether costs of professional and consulting services are an allowable charge to a military contract, the government will consider "whether the service can be performed more economically by employment rather than by contracting" and the qualifications of the consultant (Section 15-205.31 (b)).

5. Help-wanted advertising is no longer an allowable cost if it is in color (Section 15-205.33). Advertising for employees, if it is to be an allowable cost, must be authorized in advance (Section 16-504).

Moreover, the Pentagon is currently reviewing the Procurement Regulation to determine "what actions on the part of the government are necessary to assure that compensation paid to contractor employees performing on government contracts is reasonable."[9]

Some Long-Term Impacts on the Private Sector

The close, continuing relationship of the major, specialized military

[9] Department of Defense, *Defense Industry Bulletin*, Nov., 1967, p. 22. Additional proposed changes of a far-reaching nature have been reported privately. Cf. *Financial Executive*, Oct., 1967, pp. 67–68.

contractors to the governmental establishment seems to be resulting in some long-term structural impacts on this segment of private industry. Numerous specific indications are available of the limited entrepreneurial actions of the government-oriented corporations. The dependence of the shipbuilding companies on government contracts and subsidies is well known; it has resulted in that industry's failure to undertake new product development on its own or otherwise effectively to compete in the open world market.[10]

Similarly, the aircraft industry generally has made only half-hearted efforts to utilize its much vaunted engineering and systems analysis capabilty to penetrate commercial markets. Most of these attempts have been on a very small scale or were abandoned when substantial private risk capital was required.[11] During the 1963–64 defense cutbacks, these companies reacted passively to the developments, mainly curtailing their operations and waiting for government proposals to bid on civilian agency work on a cost-plus basis.

Interestingly enough, the major exception to this lack of entrepreneurship and willingness to bear risks in commercial markets is the Boeing Company, which has not won a major military competition since 1958. During the past decade, that company has invested several hundred million dollars of its own funds in commercial aircraft development, with considerable success. However, should the federal government decide to finance the great bulk of Boeing's cost of developing a commercial supersonic airliner, that would represent a return to the long-term trend of greater governmental risk-bearing.

The question of long-term impact of the governmental relationship on the private contractors may be examined by comparing the major defense companies with large industrial corporations of approximately similar size. The comparison indicates that the government-oriented companies possess important, measurable characteristics which differ from those of commercially-oriented industrial corporations and that these differences have been increasing in recent years. This would seem to support the contention that it is the military contractors who are drawing closer to the government and not, as Professor Galbraith contends, large corporations as a whole.

The following six companies were selected because their contracts from the Department of Defense and the National Aeronautics and Space Administration were estimated to be in excess of three-quarters of their total sales volume in 1965: North American Aviation, Inc.,

[10] Midwest Research Institute, *Industrial Conversion Potential in the Shipbuilding Industry*, Project 2833-D, Mar., 1966, Chap. V.

[11] Stanford Research Institute, *Potential Industrial Adjustments to Shifts in Defense Spending*, Project No. IMU-4370, Nov., 1963, Chap. VI.

Lockheed Aircraft Corp., General Dynamics Corp., McDonnell Corp., Grumman Aircraft Engineering Corp., and Thiokol Chemical Corp. Hence, these companies are as representative prototypes of the government-oriented corporation as are available. In many other cases, necessary data on large defense contractors are lacking because the organizations are subsidiaries or divisions of corporate conglomerates that only release financial data on the total company (e.g., Martin-Marietta, Litton Industries, and Textron).

Each of six companies in a civilian-oriented industry sample was chosen on the basis of similarity of sales volume in 1965 between it and one of the companies in the defense/space sample. (Generally, they were adjacent firms on the *Fortune* list of the 500 largest industrial corporations in 1965.) Each group reported on aggregate sales volume of $7.3 billion in 1965. The general industry sample contained the following business firms: National Dairy Products Corp., Firestone Tire and Rubber Corp., General Foods, Inc., Aluminum Company of America, Colgate-Palmolive Co., and Purex, Inc.

The two samples were compared, for the years 1962–65, and also for the period 1952–55, on the basis of financial characteristics, stockholder factors, and capital structure. A span of years was chosen in each case to reduce the effect of erratic movements in individual years.

As shown in Table 1, defense companies tend to operate on much smaller after-tax profit margins than do typical industrial corporations.[12] As a result of the large amounts of government-supplied capital, which are not reflected on the books of these companies, the defense con-

TABLE 1

COMPARISON OF DEFENSE AND NONDEFENSE-ORIENTED CORPORATIONS

	Average of Sample of Defense Firms		Average of Sample of Industrial Firms	
	1962–65	1952–55	1952–55	1962–65
Financial Characteristics				
Profit margin on sales.........	2.6%	3.0%	4.5%	4.6%
Capital turnover............	6.8×	6.1×	2.9×	2.3×
Return on net worth.........	17.5%	18.6%	13.0%	10.6%
Investor Evaluation				
Price/earnings multiple......	10.9	7.3	10.7	20.6
Bond rating (Moody's).......	Ba-Baa	Ba-Baa	A-Aa	A-Aa

SOURCE: *Moody's Industrial Manual*, 1952–55 and 1962–65; company annual reports, 1952–55 and 1962–65.

[12] Where the data were available, additional comparisons were made between the sample of defense companies (which covers virtually the total universe of data) and large American industrial corporations generally (based on the *Fortune* Directory of the 500 largest U. S. industrial corporations). The results were similar to those reported in Table 1. For 1962–65, the aggregate profit margin for the top 500 was 4.8 percent, the capital turnover rate was 2.1, and the return on net worth was 10.0 percent.

tractors report far higher rates of capital turnover (i.e., dollars of sales per dollar of net worth) during 1962–65. The higher turnover rates for defense companies more than offset the lower profit margins. Hence, their return on net worth (net profits as a percent of stockholders' investment) is considerably higher.[13]

It can be seen from Table 1 that the differences between the defense firms and nondefense firms widened over the past decade. The sales margins of the defense firms were closer to the general industrial sample during the earlier period (1952–55) than during the more recent years analyzed (1962–65). The same changes are noticeable for capital turnover and return on investment.

Despite the greater relative profitability, the evaluation by the stock market of the government-oriented corporations has been less favorable than of large business firms as a whole. This results, at least in part, from the inherent instability of the government market and the historical volatility of the fortunes of individual contractors. The relatively low payout ratio (the proportion of net income which is disbursed to stockholders in the form of cash dividends) may also have an adverse effect. Reflecting these factors, earnings of defense companies tend to be more fully discounted, as shown by lower price/earnings multiples—10.9 versus 20.6 for the period 1962–65. The results for 1952–55 were not substantially different.

Similar investor reluctance towards government-oriented corporations is evident in the bond market. Of the six firms which composed the general industry sample, during the period 1962–65, four were able to issue bonds with a rating of either A or Aa, one chose not to issue bonds at all, while the last placed its bonds privately. Out of the six companies in the defense sample, only one issued bonds on the market and these had a relatively low rating of Ba-Baa. One of the firms placed its bonds privately, while the other four did not issue any at all. Again, the results for 1952–55 were similar. These comparisons suggest that it is much easier for civilian-oriented firms to enter the bond market on favorable terms. It would be expected that this reflects the greater degree of risk which is imputed to bonds issued by defense firms.

An attempt to sum up the growing differences between government-oriented and commercially-oriented corporations yields a paradox, but perhaps not an unexpected one. The close dependence of the government contractors on the volatile military customer results simultaneously in higher profitability and lower investor interest. The higher profit-

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[13] The relationship among the three measures is as follows: $P/S \cdot S/W = P/W$, where

P = net profit after taxes
S = sales
W = net worth or stockholders investment

Hence, P/S = sales margin; S/W = capital turnover; and P/W = return on investment.

ability arises mainly because of the free provision of working and fixed capital. The lower stock and bond market evaluation comes about, in part at least, because of the great volatility of military requirements and, hence, of the fortunes of individual contractors.

Another factor influencing investor attitudes may be the inability of these companies to operate successfully in commercial markets because of their orientation to government requirements. Certainly other large defense contractors—such as General Electric, R.C.A., Honeywell, Litton Industries, and A.T.& T.—which receive the bulk of their sales from consumer and industrial markets encounter more favorable investor attitudes. With reference to the possibility of the disappearance of that line between the mature corporation and the state, the market at least seems to distinguish increasingly clearly between government-oriented and market-oriented corporations.

Some Policy Implications

Recent periods of defense cutbacks gave rise to demands for utilizing the research and development and systems management capabilities of military contractors in civilian public sector activities. Given another reduction in military spending in the future, such action may be an effective short-term means of preventing unemployment in defense areas. However, as a matter of long-term public policy, would it be wise for the nation to expand the use of that branch of industry which increasingly develops the characteristics and mentality of a government arsenal? To a considerable degree, the major defense companies rarely risk large amounts of their own resources in new undertakings, but primarily respond to the initiatives of the governmental customer. This course of action may be a valid profit-maximizing solution for these companies, but it hardly promotes the risk-bearing and entrepreneurship which is characteristic of private enterprise. In encouraging these companies to expand into civilian government markets, are we in the process of setting up a civilian counterpart of what has been labeled, or perhaps mislabeled, a "military-industrial complex"? Or should more emphasis be given to the possibilities of encouraging, or at least not discouraging, the eventual movement of defense industry personnel, facilities, funds, and other resources to those other industries which are more accustomed to operating in a commercial business rather than government environment? Perhaps an added and unexpected benefit of arms reduction or disarmament would be the opportunity to reduce if not eliminate this "seminationalized" branch of the American economy.

Even in extended cold war periods, the "convergence" tendencies of military contractors may need to be held in check in order to maintain their present high rate of technological innovation which forms such a

basic part of the nation's national security base. An important justification of the government-oriented (and hence publicly assisted) corporation is that it is in a position most readily to undertake innovation. Yet innovation is likely to come forth only if there remains some risk of not innovating due to competitive pressures. Such pressures may come from existing military suppliers as well as from companies now oriented to commercial markets.

The optimal in the government-supplier relationship, hence, may be substantially short of either arsenalization or the informal contact of a free market.[14] The desired result may be enough stability to assure technical competence but enough uncertainty to prod some mutual participation in the innovation process. In any event, some second thoughts may need to be given before the nation agrees to the almost uncritical demands for extending the use of the government-oriented corporation to other parts of the public sector.

[14] Some intriguing possibilities for reducing but not eliminating detailed government oversight of its contractors are contained in George A. Steiner and William G. Ryan, *Industrial Project Management* (NASA Research Paper No. 17, Grad. Sch. of Bus. Admin., Univ. of California at Los Angeles, 1966).

DISCUSSION

WILLIAM M. CAPRON: I am in the unhappy position of having to discuss a paper with which I almost totally agree and which I almost completely admire. The discussant faced with such a paper has one of three alternatives: first, he can disregard his assignment to perform as a discussant and present his own original paper; second, he can restate the arguments in the paper, presenting a kind of summary; or, third, he can nit-pick, focusing on minor points with which he can manufacture a quibble. I have had neither the time nor the ambition to follow the first course; as to the second, while, in any case, I run the danger of putting the audience to sleep, I know if I merely restate Weidenbaum's case, I will be sure of doing so—and I would also put myself to sleep; therefore, I can follow no course but the third. I will leave it to you and Professor Weidenbaum to decide how significant are the "nits" I choose to pick with his paper.

I would be delighted to go off at this point into the magic fantasy land of Galbraithia—where everyone is 6'9"—but that would be cheating since Weidenbaum has, in effect, ruled this out.

Before I raise questions and comments which Professor Weidenbaum's paper brings to mind, let me commend him for the interesting description and analysis which he presents. He summarizes many of the special constraints placed by the Department of Defense on contractors—constraints which are complemented by a lavish provision of plant and equipment. Indeed, one might suggest that just short of the complete "convergence" to which Weidenbaum points—that is a move to a true arsenal system—we have the private firm which is purely a management concern, owning no fixed capital and serving in a relatively low-level management and hiring role. Certain wholly-owned government facilities operated by private firms under management contracts fall into this pattern today (e.g., several AEC installations, Cape Kennedy, etc.). The major aerospace firms aren't quite in this category, but if Weidenbaum is correct, they are drifting in that direction.

This brings me to my first nit-pick. Professor Weidenbaum seems to suggest that the gradual "absorption" of the major aerospace firms and other major suppliers of defense hardware by the federal government, transforming them from genuine independent enterprises into extensions of the federal establishment, has been a monotonically increasing function over the past two decades or more. This may be an accurate picture, but if it is, it represents an implicit judgment that the McNamara rhetoric has been just that and no more. Moreover, it means that the major institutional change of the 1960's—a significant shift to "incentive contracts"—has not achieved one of the chief purposes claimed by the Defense Department for this shift. It is my impression that a major underpinning in the rationale for the heavy emphasis of recent years on incentive contracts has been a desire to reverse the very trend which Professor Weidenbaum describes, and at least to loosen if not cut the Gordian knot tying the major

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defense goods suppliers and the Department of Defense so closely that they were completely dependent and subservient, with their managements largely stripped of any discretionary authority. I am not suggesting that I have the evidence that the use of incentive-type contracts has had any appreciable effect on the emasculated stance of arms suppliers described by Professor Weidenbaum. But I do suggest that we need some evidence on this point before we agree with Weidenbaum that these companies are inevitably doomed to a completely captive position which has so enervated their own managements and their own bureaucracies that they can never be expected to operate effectively and viably in nondefense markets. I should add that I am among the agnostics: I doubt if "incentive contracting" has yet really much affected the relationship between contractors and the government. (In addition to this point, I have the impression that the Department of Defense is supplying a somewhat smaller fraction of the plant and equipment used by its contractors. If true, this would make possible a less "captive industry" approach to Defense contracting procedures.)

Second, I don't think Professor Weidenbaum in this paper handles, to my own satisfaction, the pieces of evidence which seem at least to be somewhat inconsistent with his basic thesis. There are firms whose roots lie in the defense-space business who, in recent years, have apparently been successful in diversifying into nondefense-space activities. Best known are the conglomerates such as Litton and Textron. Slightly different is the case of Boeing, mentioned by Weidenbaum, but apparently dismissed as a very special "sport." Finally, there are a number of larger corporations that do a significant amount of business with the defense and space establishments, measured in dollar volume terms, that also operate simultaneously and very successfully in civilian markets as well as in nondefense government markets. (I have in mind firms such as General Motors, General Electric, R.C.A., Ford-Philco, and Dow Chemical—a firm which has recently become, if not a household term, at least a campus term!) I suspect that Mr. Weidenbaum will argue that the firms he is describing are only those which from their infancy have been almost totally dependent on defense business and have never operated in nondefense markets—or maybe he would set some percent limit on sales to the Defense Department, above which a firm becomes a complete "captive." But this still leaves the troublesome question of the newly arising conglomerates, growing out of firms which were initially solely defense-oriented. Cannot other major aerospace companies go this route sucessfully?

Third, while I thoroughly agree with the paper in suggesting that most of the attempts of recent years to diversify major aerospace firms into non-space-defense activities have been abortive, I would hesitate to join Weidenbaum in inferring that this experiment demonstrates an inevitable inability of such firms to so diversify. In particular, I continue to feel that there are possibilities of redirecting such enterprises so that they can operate effectively in nondefense public sector markets. For example, a number of the problems we have lately "discovered" (though they have been with us a long time) arising out of the urbanization of America—ghettos, slums,

archaic or nonexistent mass transit, pollution, etc.—might be effectively and usefully tackled by major aerospace firms. I agree with the paper in its suggestion that one must distinguish between the resources of these firms (including the techniques they have developed, such as systems analysis) from these firms as corporate entities and from their managements specifically. I further agree that it may be much easier to redirect these resources under new and different leadership with a very different "style" than that which has developed in the aerospace agencies. But I would suggest that on the "buying" or demand side of this market little imagination has yet been shown and that we have by no means exhausted the possibility that aerospace companies can, in fact, be redirected towards different markets.

Fourth, no matter how fervently I wish for an end to our military involvement in Vietnam and to a world where significant disarmament, based on either tacit or overt agreement, can be undertaken, I am forced to conclude that for the foreseeable future we will need a significant defense capacity. This means that in a period when current procurement is being reduced, perhaps significantly, there will be enough uncertainty so that prudent national policy will require us to maintain a capability for rapid rearmament. This suggests that as a matter of national policy, we may have to maintain significant excess capacity for the design and production of the more sophisticated kinds of military hardware. Weidenbaum is aware of this need and indeed suggests we may have to restrain efforts of aerospace firms desiring to convert to nondefense activity. It therefore may be necessary to maintain a group of firms that operates in the very special environment of the aerospace industry along the lines described by Professor Weidenbaum. I don't like this prospect any more than he seems to, nor am I at all convinced that the present subservient relationship of the aerospace industries to the federal government is the most efficient or effective way to structure this activity in any case. But when we look ahead to an era of arms reduction, we must not lose sight of the probable requirement that a "quick buildup" capacity be maintained. It is not easy for me to see how firms asked to maintain significant stand-by or excess capacity can at the same time be "thrown into the market place."

Weidenbaum makes it clear that he is aware of the dangers of overdrawing sweeping inferences from his interesting exercise on six major defense firms versus six nondefense firms. He thus deprives the would-be critic of a chance to attack him for building a major argument on a too small, nonrandom sample. I agree with him that this analysis is instructive, though not definitive, and I think his explanation of the different evaluation placed by the market on the two groups of firms is a sensible hypothesis—for the individual defense-oriented firm life is risky: though the Department of Defense may not let any one of them go all the way under, the year-to-year swings in the level of activity of any one firm are relatively large and unpredictable.

I would like to suggest one normative judgment to which I hold firmly while recognizing that I can't provide an iron-clad proof: accepting Weidenbaum's picture of the inhibition of defense contractor management's limited

discretion as accurate, I would argue that from the government's (and therefore the public's) own standpoint, these constraints lead to major inefficiencies. Because of the lack of freedom we give contractors, we deny ourselves the chance to gain the major potential benefit inherent in using private firms versus reliance on a pure government-owned and -operated arsenal system. Rather than encouraging invention and innovation, the system of controls, the detailed over-sight of firm activity, the constant second-guessing—all the characteristics described in the paper which distinguish defense contractors from other private-sector firms—inhibit and discourage innovation. To overcome these inhibiting forces and maintain the high rate of technical change demanded for national security reasons requires us to devote many more resources than an efficient and economic set of organizations and institutions would require to achieve the same results.

Finally, I was struck by Professor Weidenbaum's failure to relate what he has to say to one issue over which some Americans, including President Eisenhower in his farewell address, have expressed extreme concern regarding the special status and role of the major aerospace firms—the "military-industrial complex." Indeed, Weidenbaum explicitly says he won't talk about this. These firms are neither in the federal establishment completely nor outside it and separate from it completely. If they were completely integrated into the federal government—if they were true arsenals—they would be seriously inhibited in their political activity, in lobbying, and in their occasional attempts to overtly influence the views of their employees and other citizens of the communities in which they have major establishments regarding major issues of public policy. Query: Should the Hatch Act apply any more to a military officer than it does to an executive of a firm, almost all of whose business is with the Defense Department?

One need not question the sincerity and the attempt to be objective on the part of those who work for such firms to suggest that their self-interest almost invariably and inevitably introduces a bias in their judgment on issues of major public policy having anything to do with defense. I have no solutions to offer and I feel that some statements of concern have distorted and exaggerated the extent of the set of problems created by the peculiar and special relationship between this group of firms and one part of the federal government—the relationship suggested so clearly in Professor Weidenbaum's paper. In particular, I share his apparent skepticism of the more overt "conspiracy" theories advanced to explain the symmetry in the views often expressed by the high brass in the military services and the high brass in the defense industries. But because some have overdrawn the sinister nature of this relationship does not gainsay the fact that there are real and troublesome issues inevitably inherent in the present relationship of mutual dependence between the Defense establishment, on the one hand, and some of its major "captive" suppliers, on the other.

My understanding with the Chairman was that I would concentrate my comments on Professor Weidenbaum's paper. I will, however, take the liberty of adding very brief comments on the other two papers.

I agree with Professor Benoit that it is all too easy to overstate the re-

sources which might be available for nonmilitary purposes should we be-
come a "disarming" world—at least in the short-term or near-term future.
As his estimates indicate, we are employing significant resources for defense
purposes. But even if we went as far as a GCD agreement, expenditures for
those items included in "defense" would not quickly fall to zero. And if we
travel the arms control route, we must recognize that some proposed moni-
toring and inspection schemes would employ significant resources. In short,
the case for disarmament, and certainly for arms control, does not, in my
'view, rest mainly on the argument that we can thereby raise world living
standards.

Benoit makes one statement which requires careful interpretation. He
suggests that "the elimination of such defense activity would add less to
civilian output than the amount by which military output was reduced.
Hence, the opportunity costs of such military activities are less than their
full costs in their present use." While it is true that there are significant
spillover contributions from defense activity to nondefense activities, there
are some very tricky valuation issues involved in the interpretation of the
quoted sentences. If society views defense expenditures as a "necessary
evil" (e.g., as a cost), the arms reduction will release resources to uses in
which they have a positive value rather than representing a negative value,
or cost, to society. Moreover, we must always recognize, in interpreting
Benoit's statement (which is true on a *ceteris paribus* basis only) that re-
sources now used for military purposes (e.g., R and D) which have some
civilian spillover value will be significantly more productive in, enhancing
total nondefense output if devoted directly to civilian purposes.

A quick comment on the Bornstein paper. Bornstein leaves out of ex-
plicit account the crucial relationship between the effectiveness and the
impact of sanctions on a nation against whom they are imposed, on the
one hand, and, on the other, the importance to that nation of the change in
policy demanded by the nations invoking sanctions. Thus, I suggest that
Rhodesia might have been willing to adhere to a limited arms control
agreement in the face of the present economic sanctions to which that
country has been subjected, while the Smith regime is unwilling to take the
steps demanded by the British and supported by the UN which the white
Rhodesians view as requiring a complete abdication of white control of the
Rhodesian economy and government—a price they will not pay given the
relatively modest cost imposed on them by the sanctions. In other words,
the effectiveness of sanctions cannot be assessed in any absolute sense, but
only relative to the prupose the sanctions are designed to achieve.

HOLLAND HUNTER: The central issue in the economics of arms control and
disarmament concerns the value of arms. We- are familiar with the vivid
image of a burden laid on mankind by huge unproductive defense outlays,
their cost being measured by all the peaceful goods and services foregone in
pursuit of national security. Yet civilized nations assign very high priority
to their security as states, and therefore bear these costs very willingly. Can
we, as economists, throw any light on this paradoxical dilemma? Are swords

as productive as plowshares? The valuable papers before us suggest some reflections in this vein, to which I should like to turn after brief comments on their substance.

Emile Benoit's paper makes a substantial contribution to our understanding of the dimensions involved. First, he presents up-to-date national defense outlay estimates for 120 countries; his underlying research has required a valiant attempt to obtain uniform coverage and provide breakdowns by expenditure category for as many countries as possible. Second, he has calculated exchange rates between the dollar and other currencies reflecting their purchasing power in making national defense outlays. While very crude, they appear more appropriate for this purpose than the official exchange rates that would otherwise have to be employed. Third, he offers a series of thoughtful reflections on the net gains to mankind that could come from reduced outlays on national defense. His present report is part of a larger study, the previous stage of which was reported in the Benoit- · Lubell paper that appears in *Disarmament and World Economic Interdependence* and that should be consulted along with this one.

Benoit demonstrates that there are numerous questions involved in estimating the gains that might flow from reduced defense outlays: (a) What other uses will the resources be put to? Will they stand idle? (b) Are the resources usable outside the defense sector? (c) How fast is the conversion of resources to other uses expected to take place? (d) How are resources valued in their defense uses, and how should their value in other uses be estimated? The project here under review does not focus on the first three questions. The author uses the plausible assumption that defense-outlay reductions would take place slowly enough, and modestly enough, to permit reemployment of most of the resources involved without insuperable difficulties. In this summary report, the emphasis is on valuation problems.

Here Benoit confronts what Alexander Gerschenkron once called "that great calamity of quantitative economic research," the index number problem. The market baskets of "defense" being summed up differ from country to country in composition and relative price structure. The resulting conceptual and computational dilemmas, described by Abraham Becker in his classic 1960 *World Politics* article, are not well confronted in the present report, but they clearly could not be in the face of huge data gaps. Price and quantity data in the defense sectors of most economies are simply not published in sufficient detail. Still, I wonder whether adequate attention has been paid to the question of whether unlike bundles of defense are being compared. The technological composition of national security output is certainly not the same in the United States and elsewhere, nor has its internal composition been unchanged since 1955, when some of the relationships Benoit uses were established. The difficulty is reduced, however, by the fact that a good deal of the annual flow of defense output takes the form of personnel services, measured by military pay and subsistence; Benoit has used special exchange rates here that appear to go far toward meeting this part of the problem. On the whole, the impact of these defects is probably far outweighed by shortcomings in the necessarily crude esti-

mates that had to be made for certain countries, especially China and the Soviet Union.

Even if the magnitude of these estimates is accepted as roughly correct, the aggregate may involve interpretive problems. A worldwide total for separate national outlays on defense may suggest misleading and therefore dangerous misinterpretations. It would seem to imply a single world pool of transferable resources available for international use if defense outlays were cut back. In fact, the gains from reduced defense outlays would accrue within each country. Because two-thirds of the world total is now generated by the United States and Soviet economies, it is the resources of these two "super powers" that would be freed for other uses on a large scale. As Benoit properly points out, arms reduction by itself does not assure that released resources would go into aid for developing economies or any other international end use. The two giants might put the released resources into raising their own standards of living. One can only share his hope that windfall gains might be shared with others.

These are, then, some of the difficulties associated with estimating the economic burden of world armaments. Morris Bornstein's paper deals with the difficulties of using economic rewards and penalties to influence nation states. First, it is clear that nations are willing to bear large economic sacrifices in pursuit of high-priority goals. The recent example of Rhodesia is reinforced by earlier experience with the U.S.S.R. and China. As Bornstein showed in Chapter 3 of *Disarmament and World Economic Interdependence*, large internal economic benefits have been foregone by Soviet authorities in pursuit of national security objectives. Alexander Eckstein concludes in Chapter 4 of the same volume that "it would be fair to say that the effectiveness of [Western trade] controls [in influencing China] has been extremely limited," and suggests that "Communist China's . . . arms control attitudes . . . are not likely to be significantly altered . . . by external measures."

Another grave difficulty in using economic sanctions against a transgressing state is that sanctions are costly to participants as well as to the subject. Rhodesia's neighbor Zambia, for example, simply could not afford to sever economic relations, and as Bornstein shows, Britain too has found, like the loving parent, that "this hurts me almost as much as it does you."

There are specific problems associated with using economic penalities against violators of an arms control agreement. The military advantage obtained through rearming appears to be a function of the size of the headstart obtained, so that effective deterrent penalties would have to be felt promptly. Bornstein's analysis demonstrates conclusively that export and import sanctions are too slow to be effective in this context. Perhaps serious thought should be given to a system of large fines, payable by the violator on presentation of substantial evidence, without prolonged adjudication.

What we perceive, as economists, is that the value assigned to national security is extremely high. It follows, then, that equally high rewards and penalties are required at the present stage of human society in order to make other purposes prevail. Human tradition suggests that counterre-

armament may be the strongest penalty to impose on the violator of an arms control agreement. This deterrent would minimize the advantage of a headstart and thus make the violation pointless. One notes with regret, however, that recent Soviet-American experience with antiballistic missile development suggests that pointless efforts will nevertheless be undertaken.

But there may be a more hopeful economic insight that can influence men's thinking. At present, national security expenditures are counted as part of a country's gross national product. They represent a use of resources that is universally judged by governments to contribute to national welfare. Yet defense outlays have the remarkable property that when the outlays of separate countries are added together to form a world total, they tend to cancel out each other's purposes. Individual increases nullify each other, so that the combined total of security is no greater than before. By the same token, parallel decreases in defense outlays would be costless, since the sum total of national security would not be reduced. In this respect, national defense outlays are completely different from, say, outlays on housing, which are meaningfully additive across all countries.

The paradox of our tragic dilemma is thus seen to lie in the fact that swords have value only in the presence of other swords, while plowshares have value "in themselves." Let us hope that the economics of disarmament can find ways to persuade all nations that arms reduction can be even more valuable than arms.

EXPERIMENTS IN TEACHING ECONOMICS

AN EXPERIMENT WITH TIPS: A COMPUTER-AIDED INSTRUCTIONAL SYSTEM FOR UNDERGRADUATE EDUCATION*

By Allen C. Kelley

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I. *Introduction*

Computer-aided instruction, while admitted by many to have great teaching potential, has remained for most a phenomenon belonging to the twenty-first century. The presumed necessity of expensive machines and computers, wide-scale feasibility testing, and large quantities of scarce technical and instructional resources has been considered to relegate the day of practical, economical, and extensive use of computer-aided instruction in the college classroom to the distant future.

In this paper I report on a Teaching Information Processing System—TIPS for short—which applies computers to teaching in a manner which is not only economical and implementable—indeed, it has been utilized at the University of Wisconsin—but which also contributes to the effectiveness of the educational process itself. In what follows I shall present a description of the TIPS system and report the results of an experiment in which it was used in an economic principles course. I will conclude with several observations on the long-run potential of TIPS.

II. *TIPS—Motivation and Objectives*

The problems of effectively teaching large classes, say in excess of fifty students, or of coordinating instructional programs over geographic areas—for example, extension activities—are many. First, informal information conveyed to the professor on either student performance or on student reaction to discussion sections, lectures, and reading materials is highly biased and is typically drawn from extremely small samples. With respect to student performance, the usual sources of information are rapid-fire, student-professor question and answer sessions immediately following lectures, conferences with students during office hours, and reports by teaching assistants on student performance in sections. The usefulness of the latter improves throughout the se-

mester as graduate students attain experience and increa
in teaching. Even then, however, the variability of rep\
progress by teaching assistants makes them difficult to i\
formal examinations, quizzes, and course surveys tend\
sistently satisfactory data.

Second, a problem common to all courses but especially\
large ones is that information on student performance to _used for
teaching purposes is typically untimely and costly. The information is
untimely since it is usually obtained at discrete six- to eight-week
intervals. It is costly since quizzes and exercises demand extensive
inputs of professorial, section leader, and student time.

Third, the effective use of teaching devices—workbooks, problem
sets, lectures, audio and/or visual aids, assigned or optional reading lists,
games, programmed materials, tutorials—which should ideally be
designed for the individual student (or group of students) is difficult.
Identification of students of varying capabilities or understanding of the
subject matter, coupled with designing for each student a mix of
teaching materials (a "systems approach" to teaching) suitable for
optimal and somehow "efficient" instruction, is time-consuming and
expensive. As a result, good students often waste time on exercises of
little merit; time is also wasted in evaluating these efforts. Poor stu-
dents, who should sustain different assignments, also of necessity receive
materials designed for the "typical" student. A processs of teaching
whereby instructional instruments are varied according to individual
aptitude and progress has not yet been perfected within the lecture
framework.

Finally, the possibilities for undertaking serious research on methods
of undergraduate instruction are partially constrained by the avail-
ability of data. While the research-oriented professor may speculate on
the relative merits of alternative teaching devices, his intellectual curi-
osity will not usually be sufficiently strong, given the structure of
incentives confronting the successful academician, to induce him to
undertake an adequate testing of the various hypotheses.

III. A General Introduction to TIPS

To overcome these and other problems a research project based on
TIPS is presently in progress at the University of Wisconsin at Madi-
son.[1] While this project is currently being used only in selected eco-
nomics classes, the basic concepts are quite general and can be applied
to other disciplines.

TIPS involves periodic collection of information from students regarding either their understanding of course materials or their reaction to various aspects of course presentation, such as lectures and readings. TIPS then provides a means of efficiently utilizing this information for instructional purposes. The information, currently collected on specialized forms suitable for machine processing,[2] is composed of student responses to a series of multiple-choice questions. Surveys of six to twelve questions take about five to ten minutes to administer. Within a few hours—and in the future, within a few minutes—this information is processed and summarized in three separate reports: one for distribution to each student, a second for each section leader, and a third for the professor. An examination of these three reports yields a useful first impression of TIPS capabilities.

The student report contains a summary of his performance: his response to each question, the correct answers, and the total number of his correct answers. On the basis of this information, assignments for the forthcoming period are also indicated. The assignments—some of which are required and others optional—vary considerably in nature, level, and intensity. A student scoring well may receive optional assignments and/or required work at a higher level—for example, essay writing—for which honors or extra course credit may be awarded. The student performing poorly may receive not only a heavy dose of required work but also a set of materials designed to bring him toward the mean class performance. Since on a specific TIPS survey several "concepts" may be evaluated, e.g., the multiplier, deflationary gap, and full employment surplus, the mix of assignments may vary considerably from student to student.

Additional information on the student report is generated on the basis of past as well as current performance. If the student has performed poorly over several surveys, he will be instructed on the student report to establish an appointment with the instructor or teaching assistant. Significantly, special tutorials or sections may be arranged well before the student takes his first major examination. If the student performed consistently and exceptionally well, he may be notified that a short paper may be substituted—at his option—for the midterm examination.

The teaching assistant report contains information to help him appraise the performance of his individual sections, including statistics on percentage correct by question or by group of questions (concepts), actual responses on the survey, lists of students required to establish appointments or tutorials, and so forth. Since a section leader usually

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[2] Machine readable forms are but one of many alternative means by which the information could be assembled.

is responsible for four to six weekly sections, the information on each individual section enables him to vary the way he handles each session. In one section he may emphasize the mechanics of the multiplier; in another, more advanced concepts or applications. It is significant that while tutorials and paper supervision require additional time of the teaching assistant, the experience thus far has been that the "released" time deriving from reduced grading (for students doing well) about offsets additional time spent on tutorials and paper supervision. Thus, as TIPS has been utilized to date, the emphasis has been toward allocating existing teaching inputs more effectively.

The professor report is similar to that received by the teaching assistant, although the information available applies to the total of enrolled students rather than to particular sections. With this information the professor may elect to alter lectures, section coverage, problem sets, or other teaching instruments for the forthcoming period.[3]

In summary, TIPS is a system for gathering and reporting objective and timely information useful for more effective teaching. This information, among other things, facilitates: tailoring assignments and teaching devices to the needs and progress of individual students; developing greater flexibility in course structure; imposing course discipline according to individual student motivation and aptitude; increasing the efficiency in the utilization of student, teaching assistant, and professorial time; and undertaking empirically-oriented research in methods of undergraduate education.

Ironically, rather than depersonalizing education, the computer, as used in the TIPS program, will permit instruction to move toward an individualized basis. Instead of developing more formal and structured courses designed to cope with the swelling numbers of students, TIPS allows a degree of flexibility in teaching hitherto practical only in very small courses.

The basic approach of TIPS sets it apart from many contemporary experiments in the utilization of advanced technology in the education process. In contrast to employing machines to alter basically the classroom framework, TIPS is simply a tool to assist the professor, the teaching assistant, and the student, both in and out of the classroom. It is thus not a substitute for the existing instructional framework; it is a complement to it.

IV. Pilot Project

A pilot project using TIPS in a principles of economics course was implemented during the fall semester of 1966. The primary objective

[3] Given the "cumulative" nature of much of economics, early diagnosis of deficiencies enables elimination or attenuation, not only of one misunderstanding, but also of potential future misunderstandings.

of the project was to provide the students with enough exposure to the system so that a preliminary objective appraisal of it could be obtained. Additionally, classroom experience with TIPS was needed in order to identify desirable modifications.

TIPS was introduced after the six-week examination so that comparative information on class performance and student opinion with and without the system could be obtained. In their initial introduction to the system the students were assured that this was solely an information gathering device to be used for instructional purposes, that the TIPS surveys were not examinations—the results would never be used for grading purposes—and that during the semester neither the teaching assistant nor the professor would have access to the individual scores.

A total of four TIPS surveys were administered, three prior and one subsequent to the twelve-weeks examination. The surveys encompassed groups of questions pertaining to the nature and application of nine individual topics, including the public debt, the multiplier, money expansion, price indexes, determinants of aggregate demand, impact of inflation, deflationary and inflationary gaps, full employment government surplus, and the adjustment process to equilibrium of aggregate supply and demand. Problem sets, designed to correspond to each concept surveyed, were provided as optional or required depending on student performance.

The data used to evaluate TIPS comprises responses by 278 students to an anonymous survey administered in the last class lecture. Each student revealed, in addition to responses to twenty-six questions, five attributes about himself: major, class, overall grade point average, and the scores on each of the two midterm examinations.

The organizational framework for analyzing this body of data is a cost-benefit evaluation of the system.[4] Although quantification of the desired variables is often tenuous, use of cross-tabulations, Chi-square tests, and regressions has, to a limited extent, enabled us to isolate statistically various categories of students that found TIPS particularly helpful or harmful, and why. From this information we have been able to make selected tentative inferences concerning the value of TIPS.[5] Future experiments will employ a control group to enable a more rigorous test of the nature and effects of TIPS. The present experiment can be considered as a preliminary assessment designed, in part, to identify areas of research meriting more intensive study.

Consider first the overall evaluation of TIPS by the entire class.

General student opinion was strongly supportive of TIPS as contributing to understanding economics, with particular emphasis on its capacity to point out key concepts and areas of weaknesses prior to examinations. An overwhelming majority recommended future use of TIPS in its present and even broader contexts. There was no perceptible hostility to the use of a computer in a system such as TIPS.

Five main statistical findings support these conclusions. First, 86 percent of the class felt that TIPS helped them learn the course materials either "much better" or "somewhat better" with only 12 percent registering the opinion that the system "did not help." These responses were invariant to class, major, or grade point average. Second, key benefits, ranked by students on the basis of their significance, revealed that TIPS "indicated key concepts and areas of importance" (32 percent), "pointed out areas of weakness sooner" (23 percent), and "stimulated learning materials more conscientiously and thoroughly" (22 percent). Third, in appraising possible disadvantages of TIPS, while 51 percent felt "that there were no particular harmful effects of the system," a significant proportion, 24 percent, suggested that "TIPS did not accurately reflect knowledge of the material, and thus gave a false sense of confidence." The validity and importance of this factor will be assessed in detail below. Fourth, not only did more than 90 percent of the class favor use of TIPS in principles of economics in future years, but many students (41 percent), with no measurable bias by major, felt that a TIPS program would be applicable to most other courses. Some (33 percent), however, felt it to be most useful in science and problem-oriented courses while others (12 percent) particularly supported its use in reading courses. Finally, despite the frequently acknowledged student animosity toward the use of computers in education, support for their use in TIPS was striking: 54 percent appraised computers as a "significant" educational aid, 37 percent felt them of "some help," and only 2 percent saw computers so used as "another undesirable move toward mechanized human existence."

Given the students' conclusion that TIPS contributed to learning of economics, it is important to identify the specific channels through which the system accomplished this result. TIPS motivated most students to keep abreast of their work and to review more frequently although they appeared not to be preparing specifically for the surveys.

This conclusion—deriving from a question on the final course survey asking if TIPS had affected methods of study—is supported by the finding that about 65 percent either felt "TIPS increased the tendency to do the assigned reading prior to coverage in class or sections," that "TIPS increased the frequency of reviewing the covered materials," or both. Furthermore, on another question some 76 percent indicated they did not prepare specifically for TIPS surveys. Each group selecting

one of the above alternatives comprised a representative cross-section of the sample in terms of GPA, class, and major. An underlying hypothesis, as yet untested, is that the more systematic study program induced by TIPS results in greater retention of the subject matter, in contrast to one focusing on short-term achievement accomplished by somewhat infrequent but intensive study.

Apart from highlighting its pronounced impact on study habits and motivation, students identified several additional features of TIPS as having a favorable effect on their study of economics. Students who thought TIPS helped them learn economics better (86 percent) found it most valuable as an identifier of key concepts, as a motivational device, and as a system which enabled instructors to tailor instruction to the needs of specific students. These students did not regard TIPS particularly beneficial in the role of providing extra free time or as a stimulus to attend lectures, although these features were found most helpful by those students who indicated that TIPS had not helped (12 percent) or had hurt (2 percent) their economics performance.

These results, strongly supported by cross-classifications of students by degree of endorsement and ranking of benefits, are generally invariant to the student attributes examined in the study.

Since TIPS, as it was used in the pilot project, provided significant amounts of free time compared to the amount of time students would have been required to spend on the course had all assignments been mandatory—there were, in fact, 1,000–1,500 such "released" hours— the above findings suggest the need to examine the impact of this conserved resource. Surprisingly, this free time was not considered important by the students to their performance in economics. This fact does not in itself, however, imply that conserved free time is an unimportant attribute of TIPS. On the contrary, the following several observations point to just the opposite conclusion. The freshman, who obtained a disproportionately large share of optional assignments, found the study time so released relatively more valuable than his classmates.

This result has intuitive appeal since one would expect that the value placed on free time varies directly with the opportunity-cost to each student of using the time to study economics. Since, as it was implemented, the pilot project did not provide particularly attractive alternative uses of the released time in the study of economics, it is thus not surprising that the freshman, who may have relatively time-demanding course loads outside economics and who may be less efficient in study methods, would particularly appreciate the greater flexibility accorded him by TIPS in his allocation of time. Of the two alternative uses of released time, additional study of economics and other curricular or extracurricular activity, the very bright and the very slow students in economics chose the latter, while the high-average (C+) and the good (B) students chose the former.

This observation appears consistent with the hypothesis that students determine the allocation of their time in a manner which *ex ante* optimizes their overall measured performance (GPA). Presumably the bright student, who does not require the drill of assignments, and possibly the poor student, who may be resigned to his status in the course, do not benefit from the assignments (designed for the "average" student) as much as the intermediate group.[6]

If our interpretation of the manner in which students allocate their time is correct and if it can be shown that student performance in principles of economics was not impaired by the granting of optional assignments, then the free time accorded by TIPS may be considered as a very important beneficial attribute of the system. Even if performance were impaired, in fact, the loss in this course may have been more than offset by the subsequent gain in some other course to which efforts were then directed. Thus, the finding that the performance in principles of economics was unimpaired would be a very strong result and would provide substantial evidence relating to the merits of TIPS.

A test was performed to provide evidence on the effect of free time on economics attainment. The results are consistent with the hypothesis that providing students greater flexibility in allocating their time did not impair measured student performance.

As seen in equation (1) below, "free time" (F), measured as "those students who received at least 50 percent of the assignments as optional," had an insignificant influence on the second examination score $(E2)$. While both the first examination score $(E1)$ and (GPA) entered significantly into the prediction equation, neither class, section leader, nor major contributed to the explanation of examination performance.[7]

(1) $\quad E2 = 27.49 + 34.85(GPA1) + 26.20(GPA2) + 18.51(GPA3)$
$\qquad\quad (9.10) \quad (8.16) \qquad\quad (6.36) \qquad\qquad (5.66)$

$\qquad\quad + 20.20(GPA4) + 12.47(GPA5) + 8.85(GPA6)$
$\qquad\qquad (6.64) \qquad\qquad (3.64) \qquad\quad (3.77)$

$\qquad\quad + 2.46(GPA7) + .28(E1) + 3.02(F)$
$\qquad\qquad (3.31) \qquad\quad (.15) \quad\ (2.27)$

$\quad R^2 = .45$

[6] An alternative explanation of the choice by poor students not to work their occasional optional assignments lies not in their feeling of futility, but rather is based on the premise that these students are poor in part because they lack ambition and/or motivation.

[7] *GPA* was entered as a binary variable with *GPA*1 through *GPA*7 representing, respectively, greater than 3.5, 3.25–3.49, 3.00–3.24, 2.75–2.99, 2.50–2.74, 2.25–2.49, 2.00–2.24. Under 2.00 is captured in the intercept term. All estimated parameters in the equation except *GPA*7 and *F* are significantly different from zero at the 99 percent level of confidence. The sample excludes all freshmen (since *GPA* data were unavailable), 47 students participating in a "special" experiment carried out during the semester, and a few other students for which specific data were missing.

Turning from the favorable aspects of TIPS, we should next consider the student reaction regarding the disadvantages of the system as employed. While a surprisingly large number of students felt that "there were no particular harmful effects of the system" (51 percent in all), 24 percent of the class did answer that "TIPS did not accurately reflect knowledge of the material and thus gave a false sense of confidence." The relevant issue here is one of assessing the significance of the "false confidence" cost. Two arguments appear particularly appropriate. First, an attempt was made to test statistically for a differential influence of survey results on second examination performance for the group who indicated "false confidence" as a concern as opposed to the remainder of the class. The results of the regression experiment employing *GPA* in binary form and average survey performance as independent variables indicated that survey performance directly, and thus false confidence indirectly, did not demonstrate a significant differential impact on examination performance as between the two groups. Second, one could argue that the problem of false confidence arises from all teaching methods which offer students interim appraisal of achievement; namely, maintaining motivation in the wake of success.

A final but extremely important issue relating to the appraisal of TIPS is its ability to discriminate student competence. Recall that the information upon which the program operates is obtained from a periodic sampling of student performance under non-examination conditions, using multiple-choice questions. Two pieces of information suggest that TIPS performs acceptably in its measuring capacity. First, several regression experiments showed that the surveys apparently contributed slightly more to the prediction of the second examination score than even the first formal class examination. While the TIPS surveys were admittedly more closely related in subject matter to the second examination, neither the similar formats of the two examinations nor the fact that the surveys were offered under non-examination conditions tended to outweigh the superiority of surveys vis-à-vis the first examination in predicting subsequent performance. Second, of those students who had an opinion regarding TIPS measurement capacity, 69 percent felt that the surveys were either a "particularly good" or a "good" measure of knowledge of those materials covered by TIPS.

My own view, as yet unsubstantiated, is that properly designed multiple-choice questions can reliably measure student competence at least at the general diagnostic level to which TIPS is aimed. Admittedly the measures may not provide an adequate reflection of the creative or exceptional abilities of the very capable student. However, since this student can be identified as possessing an understanding of the basic

concepts, the additional capabilities of TIPS in providing him with options of essay writing and research papers may ultimately allow an accurate appraisal even of this student.

V. *The Potential of TIPS*

While the initial results of the pilot project at Wisconsin indicate that TIPS can be effectively utilized in an economics classroom, two factors are frequently cited relating to the practicability of its implementation on a large scale.

First, concern is expressed about the demands placed on scarce professorial time in designing adequately discriminating surveys and properly individualized problem sets tailored to the differing needs and abilities of the students. In recognition of this problem, a comprehensive bank of questions and problems classified by concept, together with extensive tutorial materials for the weaker students and suggested projects for the more able students, is presently under development.

Second, the availability and costs of "hardware" (computers and input-output devices) are often posed as constraints, not only on TIPS, but on most computer-aided instructional systems. However, most large universities already possess or have access to the requisite equipment, though not necessarily in an optimal configuration for a large-scale TIPS program. Finally, a detailed cost analysis of the TIPS pilot project revealed that computer, labor, and overhead costs (including a portion of the research and development costs) required to run the system yielded a maximum average total cost of about one dollar per student per semester.[8] With more efficiently designed computer programs and logistical systems, with the economies deriving from large-scale utilization, and with greater experience, average costs would lie in the twenty-five to fifty cent range. TIPS can thus be viewed as a feasible low-cost method of increasing professorial control over the instructional process.

The expansion in the range of choices open to the professor in teaching is a particularly valuable means of summarizing the role of a system such as TIPS. One might view an economics class at matriculation as normally distributed across some range of economics knowledge. Instruction then involves shifting and/or skewing this distribution so as to maximize some prespecified objective function. Thus, for example, one may wish to raise the mean level of performance while maintaining the distribution of performance among students as constant. Alternatively, one might seek to maximize the total increment to knowledge. A specification of the objective function would undoubtedly involve both economic considerations and social judgments. Given the objective

[8] Frederick M. Freymiller, "TIPS: A Cost-Benefit Analysis" (June, 1967, mimeo.).

function, together with information relating to the educational payoff
of alternative teaching instruments for students of varying capabilities
and aptitudes—that is, the production function—TIPS could then
readily be used to implement an "effective" program of instruction
developed by the solution to this constrained maximization problem.[9]

It is not clear, a priori, what the format of this instructional program
would be. For example, with a fixed level of resources one may realize a
greater total increase in economics knowledge by redirecting resources
away from the most capable students and toward the weak or average
students where the return from more intensive instruction may be
relatively high. In fact, given the currently somewhat rigid curricular
structure offered in most universities, even if the educational returns per
unit of input of raising the level of economics competence for a group
of students (most likely the bright ones) are relatively high, unless credit
is awarded or redundancy reduced in subsequent course offerings, the
returns deriving from such a reallocation may be overstated. Needless
to say, the above framework could also be employed to minimize costs
(as distinct from maximizing output), given a specified level of output.

This discussion serves to illustrate possibly the most important
short-run benefit to be derived from a system such as TIPS; namely,
increased flexibility in meeting the educational needs of individual
students. The system does not dictate the professor's approach to
teaching, but rather provides him objective and prompt information on
individual student knowledge—information to be used in any manner
he chooses. This choice may be made by different professors on the
basis of quite diverse philosophies of education.

The long-run potentials for TIPS are even more numerous and im-
portant. By providing extensive, disaggregated information that has not
formerly been available at sufficiently low cost, TIPS could provide the
means of revealing the differential impacts of alternative teaching
methods on various types of students. More "scientifically-based"
prescriptions would then become practical in a field that has too long
remained a subjective art. Additionally, research could blossom into
areas such as instructional programs aimed at maximizing alternative
educational objective functions, refinement of measures of economic
and other knowledge, and differential techniques for motivating various
classes of students.

Viewing the professor in a dual role as a researcher and teacher, the
implementation of TIPS could reinforce the complementarities between
the two roles and increasingly enable a professor to fulfill both func-
tions simultaneously. In fact, given the research orientation of many

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[9] As a part of the TIPS research project a considerable amount of effort is presently being
planned to fill partially the "gap" in our knowledge of these payoffs.

academicians and a reward system which cultivates this orientation, the possibility that TIPS may induce research in the areas of economics education in particular, and in college instruction in general, suggests that herein lies possibly the single most important contribution TIPS can make to the educational process.

A SIMULATION POLICY GAME FOR
TEACHING MACROECONOMICS

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The recent increase in research on undergraduate education is a development we applaud. The few quantitative studies that exist[1] and our own biannual despair upon reading our students' exams suggest that undergraduate teaching falls far short of acceptable levels of effectiveness. We are reluctant to blame this on a general lack of effort by faculty or by students or to accept the notion that economics is inherently uninteresting or too difficult for undergraduates to master. Unfortunately, it seems clear that growing enrollments and the increasing complexity of the subject will increase the problem.

Various techniques have been suggested to improve undergraduate teaching. This paper reports our experience with one of these: classroom gaming in the area of macroeconomic theory and policy.[2] A classroom game consists of an artificial environment in which the student plays an active role in pursuit of some objective. In our game the environment is an aggregative simulation model of an economy; the student's role is that of a policy-maker trying to avoid unemployment and inflation.

An appropriately structured game has several advantages over conventional methods of teaching aggregative economic theory and policy. As psychologists are fond of telling us, teaching is more effective where students actively participate in the learning process, receive continuous feedback, and have the opportunity to repeatedly apply new ideas in a variety of contexts.[3] Too often notetaking—getting down the instructor's "pearls of wisdom"—and passively poring over pages of textbooks become the primary activities of the student. Since participation in a game both entices involvement (because it is fun) and requires involvement (because an active response must be made), a game situation can be expected to be relatively successful in capturing the student's

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[1] See, for example, G. L. Bach and P. Saunders, "Economic Education: Aspirations and Achievements," *A.E.R.*, June, 1966.

[2] A previous effort in the macro area is discussed in R. Attiyeh, "A Macroeconomic Model for the Classroom," in *New Methods in the Teaching of Economics*, K. G. Lumsden, ed. (Prentice-Hall, 1967). An example of the use of games for teaching other topics in economics can be found in M. L. Joseph, "Role Playing in Teaching Economics," *A.E.R.*, May, 1965.

[3] For a useful survey of learning theory, see G. L. Bach, "Student Learning in Basic Economics: An Evaluated Experimental Course," in Lumsden, *op. cit.*

attention. The response of students to our teaching game seems to bear this out.

A classroom game also provides continuous feedback. The student learns in short order where his policy decisions achieve their objectives and receives immediate reinforcement for successful performance. We feel this is a great improvement over two or three exams during the semester.

A third advantage of our game as a teaching device is that basic concepts can be applied in numerous and diverse concrete situations. The game provides the student with the chance to be a user of the income and expenditure theory he is studying.

In addition to providing a favorable learning environment, a classroom game will also have a desirable impact on the economic content of what is taught. We feel that most students do not acquire an adequate understanding of what economic theory is or how it relates to either economic policy or everyday economic events. In the game situation, the student is confronted by a set of data on economic variables, such as NNP, employment, etc., and is given the objective of changing these variables through economic policy. He is forced to use economic theory both to order and make sense of this mass of information and to instruct him on how the policy tools at his command should be used. Under these circumstances, theory will be viewed as a useful tool for understanding economic events rather than as mechanical rules for manipulating a set of abstract relationships all of which appear unrelated to the real world.

I

Our basic goal was to build a quarterly model which would provide "realistic" behavior roughly in accord with the profession's view of how the economy works. However, at the same time we wanted to keep the model simple so that (at least *ex post*) the "data" would be explainable to students. We also wished to provide rapid computation—an important attribute for a classroom game.

The major portion of our model economy is concerned with aggregate demand. The equations bear a similarity to the standard textbook models which include a monetary sector. There are no lags of any consequence. Consumption is a linear function of disposable income while disposable income, taxes, and retained earnings are linear functions of NNP. Government spending and the money supply are exogenously determined. Investment is related negatively to the rate of interest and positively to income. Finally, the rate of interest is related negatively to the real money supply and positively to the level of NNP.

On the supply side the model incorporates a production function

which places a ceiling on achievable NNP (potential output) and which
is relevant to the determination of unemployment and prices. Potential
output is determined by a Cobb-Douglas production function with a
constant rate of technological change. There are two factors of produc-
tion: labor, which grows at a constant rate (exogenously determined),
and capital, which is augmented through investment. In a golden age,
potential output grows at an annual rate of about 2.6 percent. In the
short run, however, the rate of growth depends on investment. If invest-
ment is about 20 percent of potential NNP, the annual rate of growth
will be about 3.5 percent.

The production constraint enters in the following way. If, for any
quarter, aggregate demand exceeds potential NNP, realized NNP is
held to potential and there is inventory disinvestment. The quantity
of this disinvestment is the difference, evaluated at potential NNP,
between aggregate demand and potential NNP. For the next quarter,
firms attempt to make up inventory disinvestment, so the investment
equation has an add-on term equal to the last quarter's disinvestment.

In the last part of our model, the Phillips curve, rates of unemploy-
ment and price change depend on the ratio of realized to potential NNP.
The unemployment rate follows Okun's law. Roughly speaking, an
increase in output (relative to potential) of 3 percent corresponds to a
reduction in the unemployment rate of one percentage point (and vice
versa). At full employment, the unemployment rate is 2.5 percent.
Prices are stable when the ratio of realized to potential output is about
.9, corresponding to an unemployment rate of about 5.5 percent; at 2.5
percent unemployment, prices rise at about 6 percent. For unemploy-
ment rates above 5.5 percent, the rate of price change is linearly related
to the unemployment rate. However, the relationship is nonlinear
(quadratic) for unemployment rates below 5.5 percent.

II

As a backdrop for the discussion below, it would seem useful to pro-
vide some description of the environment in which this classroom game
was played. The class was a special section of a macroeconomics course
at Stanford's Graduate School of Business in the spring quarter of
1967. The subject matter was at a level of technical difficulty compar-
able to most intermediate courses. These M.B.A. students were for the
most part short on interest in theoretical refinements and long on
interest in applications to public and business policy questions. Our
staff was in sympathy with this balance; consequently, a course outline
was constructed which would provide the basics—without sacrificing
the more important theoretical problems—but contain a heavier dose
of applications than most intermediate courses. The game was not fully

integrated into the curriculum; rather, it was a parallel development which began about halfway through the quarter and continued to the end.

Playing with about fifty students posed no small problem in expediting the submission of decisions, preparing the input for the computer, and returning each quarter's output. We wanted to get in a large number of iterations to sustain interest and to develop a variety of lessons. At the same time we wanted to avoid overtaxing the student, who after all had other responsibilities which prevented him from devoting large amounts of time to this part of the course. The class met three times a week—Monday, Wednesday, and Friday (at 8 a.m.); so it appeared that three quarters per week was a reasonable target.

Students submitted each quarter's decision on a special form; they were identified by number and by name and each reported the change in his decision variable. Thus if a player for one reason or another missed a round, he would have a quarter in which no policy change was made. The decision forms were processed after class by the instructor and an assistant and were recorded for transmitting to three IBM cards. These three cards were punched, changes in the exogenous variables made where appropriate, and the program deck submitted at the computer center.

The run, using two tapes for history, required about one minute on an IBM 7090 and produced several pages of output which were cut into strips and returned to the boxes of the individual students. Usually the returns were made late the same day or the following morning. This gave the students an overnight deliberation period before their next decision was due.

Although we thought that involving students in a policy game would stimulate their interest and increase their appreciation of the need for an analytic framework to understand economic events, we also hoped the game would prove useful in driving home some specific lessons of macroeconomic theory. These lessons break roughly into three types and our policy assignments were designed to illustrate them sequentially. First, we wanted to give the students some understanding of how aggregate demand is determined and how the basic tools of stabilization policy work. Our second objective was to have students discover the connection between unemployment and price changes and the level of utilization of the economy's resources. Lastly, we hoped to give some insight into the difficulties of achieving several goals simultaneously.

When the game was first announced, students were given the 20 quarter history of NNP accounts shown in the first ten columns of Table 1. They were told that their economy resembled the U.S. economy in some ways, but that we would not provide precise knowledge of its

TABLE 1

NNP Accounts

QTR	Y	C	I	G	T	YD	RE	M	R	U	PCHG	YCHG
1	500.0	303.5	104.5	92.0	110.0	315.0	75.0	125.6	4.00	5.76	0.02	0.02
2	488.7	297.9	101.8	89.0	106.6	308.8	73.3	122.4	4.00	6.68	-0.33	-9.10
3	482.5	294.9	102.6	85.1	104.8	305.4	72.4	122.4	3.82	7.28	-0.51	-5.00
4	495.4	301.2	106.0	88.2	108.6	312.5	74.3	126.1	3.73	6.77	-0.35	10.64
5	519.7	313.2	110.6	95.8	115.9	325.8	78.0	131.9	3.72	5.61	0.13	19.63
6	535.6	321.1	110.6	103.9	120.7	334.6	80.3	133.3	3.91	4.95	0.78	12.22
7	543.6	325.1	110.2	108.3	123.1	339.0	81.5	134.0	4.01	4.75	1.04	5.99
8	549.1	327.8	109.9	111.4	124.7	342.0	82.4	134.6	4.07	4.70	1.11	4.07
9	557.0	331.7	109.2	116.1	127.1	346.3	83.5	135.1	4.20	4.52	1.39	5.73
10	568.5	337.4	110.4	120.7	130.6	352.7	85.3	137.6	4.23	4.13	2.03	8.28
11	570.3	338.3	103.8	128.2	131.1	353.6	85.5	133.1	4.66	4.29	1.75	1.24
12	580.1	343.1	99.6	137.3	134.0	359.0	87.0	131.2	5.03	4.01	2.27	6.87
13	593.0	349.5	103.3	140.2	137.9	366.1	88.9	136.1	4.92	3.55	3.21	8.91
14	594.8	350.4	106.5	137.9	138.4	367.1	89.2	140.0	4.70	3.71	2.88	1.20
15	596.4	351.2	108.1	137.1	138.9	368.0	89.5	142.5	4.58	3.87	2.53	1.09
16	595.7	350.9	107.5	137.3	138.7	367.6	89.4	142.9	4.57	4.16	1.99	-0.43
17	599.8	352.9	109.7	137.2	139.9	369.9	90.0	145.8	4.45	4.19	1.93	2.72
18	596.6	351.3	111.7	133.6	139.0	368.1	89.5	147.9	4.25	4.60	1.26	-2.10
19	600.7	353.3	112.3	135.0	140.2	370.4	90.1	149.3	4.22	4.64	1.20	2.72
20	596.1	351.1	113.0	132.0	138.8	367.9	89.4	149.9	4.09	5.11	0.59	-3.04

Definitions

QTR = Quarter
Y = Net national product
C = Consumption
I = Net investment
G = Government spending on goods and services
T = Government tax receipts
YD = Disposable income
RE = Corporate retained earnings
M = Money supply
R = Rate of interest
U = Unemployment rate (percent)
PCHG = Change in prices (percent) at annual rates
YCHG = Change in NNP (percent) at annual rates

structure. The first assignment was to manipulate the tax exemption to achieve a target NNP of 610. They were advised that G (government spending on goods and services) would be held constant and that until further notice the monetary authority would endeavor to hold the rate of interest unchanged at 4.09—a "neutral monetary policy."

Immediately the student was required to become a theorist.[4] What is the underlying structure of his economy? In particular, what is the relationship between NNP and the tax exemption? Changes in NNP over the first 20 quarters could not be attributed to fiscal policy alone since monetary policy was generally not neutral. However, there are several pairs of quarters with almost identical interest rates; thus the astute student was not without evidence on what happens when monetary policy is used to hold a constant interest rate.

Left to their own devices, the participants' decisions on lowering of the tax exemption ranged from 1.4 to 30.0; the appropriate response was 5.3. While only one was exactly on target, nine selected 4.2. This seemed curious; on closer inspection of Table 1, it can be seen that historically a $3\frac{1}{3}$ increase in NNP has accompanied each unit increase in taxes which is not surprising since the slope of the tax function is 3/10. If one (erroneously) takes $3\frac{1}{3}$ to be the tax multiplier, then dividing this multiplier into 13.9 (the change in target NNP) yields 4.2. Of course this method, if consistently applied, calls for an increase in taxes, but this subtlety did not deter our nine. Thus the first lesson was created: simple fitting of historical data is no substitute for theory.

One of the pitfalls in a game such as this is the danger that the players become frustrated at an early stage by the complexity of the moves. Such frustration is not conducive to learning at that time and has the added effect of making learning on future moves less likely. To minimize this problem, we proceeded at a slow pace. For the first three quarters, only the target level of NNP was changed and in each case a single instrument, the tax exemption, was used.

For quarter 22 target NNP was raised to 615. Since there had been no change in other exogenous variables, students now had some empirical evidence on the tax exemption multiplier. This was reflected in a less diffuse response; one-half were within 615.0 ± 3.0. Only 30 percent had been that close in the first quarter.

In quarter 23 target NNP was raised again—to 625. Overall performance was not greatly improved. While a number of players who had

been wide of the mark moved to within ± 3, almost as many moved out of this range.

At the conclusion of the 23rd quarter, most of the students had a quantitative estimate for the tax multiplier (their task was made easier because they were dealing with an instantaneous adjustment model). They had also developed familiarity with the data and had some feel for their economy. To help those few who were struggling to stay with their assignments, the tax function was released—by the Office of Business Economics—at the close of quarter 23. Each student learned, if he had not already deduced it, that changing tax exemptions moved the intercept of the tax function.

For quarter 24 a new wrinkle was added; government spending would be increased by 10. NNP was to be permitted to grow by 5 to 630. The lesson here, of course, was that the tax multiplier is less than the government expenditures multiplier; so the excessive portion of government spending must be offset by an increase in taxes of a greater amount. Unfortunately, a good number learned about this difference only in retrospect. Of those who were close to quarter 23's target, about 40 percent made quarter 24 decisions which would have looked good if the two multipliers had been of equal magnitude. To permit players to recover, the quarter 25 target was unchanged, and government spending was held at the same level. The number of players who were within three of target NNP approximately doubled.

Players were informed that Congress would not consider tax legislation for quarter 26; consequently, they would be forced to rely on monetary policy.[5] They could change the money supply to achieve their (unchanged) goal of NNP = 630. While this sounds like a trivial problem, it required a hypothesis of how money influences NNP. The most popular techniques used to predict the effect of M on NNP were a quantity theory approach (with constant velocity assumed) and a slightly less direct approach of fitting a relationship between money and investment. (Very few had deduced that at least in this economy the money supply works through the interest rate on investment.)

One of the advantages of keeping the quarter 26 NNP target unchanged was that for most students a small change in the money stock was appropriate. Thus they were able to avoid wide swings as they felt their way into the task of using money as their policy instrument. In this quarter, one-half were within three of target NNP. It was (and is) our feeling that one of the important elements in our "learning by doing" approach to policy making is the insights that come from trying to figure out why one's expectations were not fulfilled. Most students

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[5] In retrospect, we wish we had included a quarter where the money supply was unchanged. With r fixed the tax multiplier was about 3, but with M fixed it would have been only 1½. The moral, of course: money affects the impact of a tax change.

seemed to get most excited when they got close to target and could smell the scent. We were reluctant to discourage them at this stage by setting up a target which required a large change in M and thus would lead to large absolute errors if they were off on their estimates of the impact of M. To provide a second chance for those who nevertheless did land wide of the mark as well as to solidify the preliminary observations of those who were close, the assignment was unchanged for quarter 27. About 70 percent came within three of the target.

For quarter 28 we announced an increase in investment plans of 5 (the McGraw-Hill survey). Target NNP was raised by 5 and the money supply remained the only policy instrument. A good understanding of the effect of a change of M on NNP was required. An additional trap was available since the increase of 5 did not include induced investment. Perhaps not surprisingly, performance for this quarter fell off. The proportion within target plus or minus three dropped to one-half.

For the first eight quarters, policy-makers had been changing the tax intercept or the money supply to obtain a given level of NNP. At quarter 29 they were given data on the unemployment rate, changes in prices, and changes in NNP (see Table 1). They were informed that the Administration had been concerned with the high rate of unemployment which for someone on target for quarter 28 had climbed to about $5\frac{1}{3}$ percent. Their task was to change the money supply to obtain an interim goal of $4\frac{1}{2}$ percent unemployment. This caused a certain amount of difficulty. The relationship between unemployment and output follows Okun's law. However, this relationship is complicated by growth in potential NNP; if the level of NNP stayed constant, unemployment would increase over time. The results for this quarter showed only 20 percent within one quarter of a percent of the target unemployment rate.

For the last four quarters multiple targets were assigned. In quarter 30, government spending was increased by 10 but, because of inflationary pressures, policy-makers were instructed to hold unemployment to $4\frac{1}{2}$ percent. At the same time, because of a desire to trade off between the balance-of-payments deficit on the one hand and investment and growth on the other, the rate of interest was also to be held unchanged from its quarter 29 level. Only one instrument, the money supply, could be used. The lesson, that two goals cannot be achieved with one instrument, was figured out by the more astute; for the others the problem was later illustrated with an algebraic analogy.

In quarter 31, targets on unemployment and interest rates were again assigned. This time two instruments were provided; policy-makers could change tax exemptions as well as the money supply. While there were accuracy problems in achieving the goals (given uncertainty of model structure and parameter values), in principle this task could be

achieved. In fact a number of players did fairly well. Sixty percent were within .3 of meeting each objective. The lesson: two goals could be achieved with two instruments.

Attention was shifted to the rates of inflation and unemployment for quarter 32. The change in the price level was to be held at 1 percent, and target unemployment was 4 percent. Again two instruments, tax exemption and money supply, could be used to pursue two goals. This time, however, the two goals were inconsistent. The target, as some of the students were able to point out, was not on the Phillips curve. (Because of a programming error, this quarter was not actually run; however, several students revealed in class that they had plotted the Phillips curve and thus spotted the inconsistency.)

For the final quarter, policy-makers were asked to set their own goals. They were given special forms on which they were asked to list possible target variables, state (quantitatively) what they would like to achieve, state what they think they could achieve, and justify their responses. The effect of time pressure at the end of the term was evident on many of the responses; however, several generalizations are of interest. First, although most of the students seemed to have a relatively clear notion of the conflict in objectives, many of them did not separate out their preferences from the opportunities available to them. For example, few students talked about their marginal rate of substitution of unemployment for inflation. Most students were concerned about the objectives specifically analyzed in the game although a few mentioned other possible objectives (for example, government deficit and growth). Surprisingly few made any reference to balance of payments.

III

Although there is obviously much more to learn about the best way to use a policy game in teaching macroeconomics, it seems appropriate to summarize briefly some of our tentative conclusions as well as some of the questions which we feel are in particular need of further study.

Complexity of the Model. Access to high speed computers creates a temptation to build a large sophisticated model complete with lags and stochastic terms. Such complications would undoubtedly add to the empirical realism of the "economy's" behavior and, at the same time, provide an opportunity to illustrate a variety of econometric problems.[6]

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[6] Of course, a number of econometric lessons emerge from our simple model. One, which we must confess was not planned, came to light on the last day of the game. The students had been given the equations which governed the operation of their economies. A few students had hypothesized that investment was influenced by retained earnings and not by NNP. When they were told this was an incorrect guess, one of them pointed out there was no way he could deduce this from the data since retained earnings were proportional to NNP. This led us to construct an example (involving corporate tax rates) where the incorrectly specified investment relationship (even though consistent with historical data) led to an inappropriate policy prescription.

Our feeling, however, is that turning students loose in a complex economy is a bit like throwing children into the water to teach them to swim. Even a relatively simple deterministic model generates data which look rather chaotic to an untrained eye. In the early stages of our experiment, we attempted to simplify matters by fixing interest rates and allowing players only one instrument of control. Even so, a number of students reported considerable frustration in trying to figure out how fiscal policy works. If the student is to gain any understanding of how his economy operates, the changes in economic variables period to period must be due to changes in exogenous factors he knows about—and not too many of those.

Moreover, a number of more complicated lessons can be illustrated even in our relatively simple model. To mention a few: the policy mix affects the composition of aggregate demand and thereby the short-run rate of growth; taxes and other leakages decrease the size of the multiplier; increased government spending (with a given supply of money) has a depressive effect on investment; decentralized policy making (e.g., separate monetary and fiscal authorities who are not permitted to talk to each other) may be inefficient.

Organization. Even with a relatively simple model and simple policy problems, a substantial fraction of students are likely to need periodic alignment. Unless the student is in the neighborhood of his target and is given adequate feedback on his past failures, he will have little chance to engage in "fine tuning," and the subtlety of some of the policy lessons is sure to be lost. There are a variety of ways to handle this problem. One is to post the performance of all of the students which would allow the poor performers to benefit (*ex post*) from the experience of the better. Another possibility is to organize the students into teams.

Our experience also indicates that certain mechanical aspects of running the game can have a substantial impact on its success. On those few occasions where there was an unusual delay, because the computer was down or because there was an error in the submission, a number of students complained that they did not have time to consider their next decision leisurely. Also, it turned out that some of the more conscientious students were frustrated by the amount of time required to check out empirically some of their theoretical hunches. This was especially true of multivariate relationships. (In a more advanced version of our game, we will consider a plotting service. To avoid immoral requests, we would restrict this service to one at a time and require a justification for each hypothesis.)

It cannot be stressed too strongly that—if an exercise such as this is to be played at low key—extreme care must be taken to create the impression that the operators know what they are doing. Even in games which result in a major grade for students, they see themselves as

players and are easily discouraged when something goes awry. Conversely, they can be induced to take games very seriously if they feel there are important things to be learned and have the confidence that the instructor has designed a good learning experiment.

Misplaced Concreteness. One of the pitfalls of any simulation game is the possibility that the student will "learn" too much. For example, he may learn that the economy is a simple system which can be controlled by changing a couple of variables. Similarly, he may learn that, say, money matters a lot or a little.[7] Perspective on the simplicity of the model can obviously be given in the classroom. The game itself, however, can be used to dissipate misplaced beliefs in particular parameter values, as well as to provide an understanding of the importance of different structural specifications for the conduct of policy. This might be achieved by giving different students the task of pursuing the same objectives in different environments (for example, in a simple extreme Keynesian or extreme classical model). The performance of the different economies could then be analyzed in the classroom.

Finally, the big unanswered question is one of evaluation of what the students actually learned. We decided to make participation in the game optional and to rely on the inherent interest of games, along with the carrot that it would probably facilitate students' understanding of the basic principles. Of a class of fifty-seven, only five never played, although it must be admitted that the participation of a number of others was rather casual. Unfortunately, since the game was a small portion of the total activities in the course, there was no adequate way to assess its contribution. Nevertheless, we feel that in comparison to the standard teaching techniques, a number of topics were economically covered. At the end of the course, a general questionnaire was administered. While the results were mixed and it was difficult to spot evidence of greater economic understanding, one generalization did seem warranted. Most found the game a worthwhile learning experience and recommended its role in the course be increased. Those who expressed reservations about the usefulness of the game for the most part prescribed expansion as a medication for their dissatisfaction.

In future experiments, we plan to increase the game's share of the course and construct an experimental design which will permit some evaluation. To promote experiments, we will be happy to provide specific information on the operation of this particular game (at marginal cost) to anyone who wishes to use it—if he will agree to provide us with some feedback on his experience.

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[7] The conventional teaching techniques are not without their pitfalls. How often does a student learn that the world is an algebra (geometry?) problem?

AN EXPERIMENT WITH TELEVISION IN THE ELEMENTARY COURSE*

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Although the teaching of principles of economics is the primary undergraduate endeavor of most economics departments in terms of both staff commitments and student enrollment, we have remarkably little empirical information as to the effectiveness of alternative instructional arrangements. Only in very recent years have those concerned with the principles course begun to innovate pedagogically and to measure statistically the performance of their students [1] [2] [3] [5] [7] [8] [10] [11].[1] The purpose of this study is to compare the performances and attitudes of students who took their principles by closed-circuit television with those taking the course under more conventional circumstances.

I. Background of the Experiment

During the 1964–65 academic year, the author recorded on video tape some ninety fifty-minute lectures expressly for the principles course at the University of Nebraska. Since that time the vast majority of students taking principles at the University have viewed three of these lectures each week over closed-circuit television in classes of 50 to 60 students each. The televised lectures are not supplemented by "live" discussion. Students can, however, ask questions of graduate assistants informally before or after class or at regularly scheduled office hours.

Although the bulk of the principles students took the course by television in the fall of 1966, the author also taught two live sections. One of these was a relatively small section of 27 students. The other live section was quite large, containing 140 students. The same body of material was covered in these two live sections as is embodied in the taped lectures. Opportunities for class questions and discussion were greater in the small live section than in the large live section wherein the presentation was necessarily more formal and more structured.

The fact that these three distinct instructional arrangements—television sections, the small live section, and the large live section—were

[1] Bernard F. Haley [6] has effectively described recent experimental courses in elementary economics.

all taught by the same instructor in the same semester, covered the same body of material, and employed the same textbook and supplementary materials, provided an excellent opportunity to compare the performances and attitudes of students in these three groups under tightly controlled conditions. Furthermore, recognizing that graduate assistants assume a major portion of teaching responsibilities in the principles course at many large universities, three modest-sized sections of 41, 46, and 49 students were taught by competent, but inexperienced, graduate students to allow this further comparison. The objective of the present study is to make comparisons with respect to the performances and attitudes toward the course and the means of instruction of students taking the principles course under these four different classroom arrangements.

II. *The Testing Program*

At the outset, it is essential to describe both the "internal" and "external" testing programs employed in this project. The internal testing program refers to the examinations prepared by the author on the material specifically covered in the course. The external testing program consists of examination materials prepared by economists not associated with this study and not designed specifically to measure performance in this particular principles course.

Internal Testing Program. All four groups were subjected to the same internal examination program. This program consisted largely of three one-hour examinations, each consisting of 50 five-option multiple-choice questions, given at appropriate intervals during the semester. Each hour examination covered a rather distinct unit of work and each was scored on the basis of the number of correct answers. All students in the four groups also took the same final examination, 20 questions of which were included as part of the internal testing program. All examinations were given at a common hour for all students, thereby eliminating any possible bias for a particular group as the result of a time advantage. Hence, during the semester students in all four class arrangements were exposed to the same 170 multiple-choice questions, administered under near-identical conditions.

These 170 questions were prepared by the author specifically for this project in order not to duplicate questions used in prior semesters. Furthermore, these questions were of three quite distinct types: factual, conceptual, and problem-analytical. Forty-six of the questions were of a factual or "basic data" character. E.g.: How has the absolute and relative size of the public debt changed since World War II? What percentage of the federal government's tax revenues are derived from the personal income tax? What is the major source of financial support for research and development activity in the United States? Also included

in this category were a number of questions on supplementary readings which asked students to identify the arguments or viewpoints of particular writers or institutions.

Another 57 questions were formulated to evaluate the student's ability to define or identify basic economic concepts and/or to understand important characteristics of these concepts. These conceptual questions dealt with such notions as the various measures of national output and income; the propensities to consume and save; the investment and balanced budget multipliers; inflationary and deflationary gaps; demand and supply; the law of increasing costs; regressive and progressive taxation; built-in stability; the principle of equal advantage; and so forth.

The remaining 67 questions were analytical-problem-type questions wherein students were required to interpret graphs or to manipulate data in solving problems. Students were asked to determine, for example, the possible causes of various shifts in supply and demand and the effects of these shifts on equilibrium price and quantity; to determine the impact of a given change in the price of one commodity upon the demand for substitute and complementary commodities; to designate appropriate specializations, gains from trade, and terms of trade on the basis of given comparative cost data; to calculate the value of the multiplier from appropriate data; and so forth.

The use of these three different types of questions was for the purpose of determining whether, aside from overall student performance, one or the other of the various types of instruction is most suitable for a given type of subject matter. More specifically, this classification of questions was prompted by an earlier study [7] wherein it was found that "The American Economy" television series was as successful as conventional lectures in conveying a factual understanding of the economy but less successful in providing students with an understanding of specific concepts and analytical tools.

External Testing Program. The program of internal testing was supplemented by a two-part program of external testing. First, the familiar Test of Economic Understanding (TEU), comprised of 50 four-option multiple-choice questions, was employed. Form A was administered at the start and Form B at the end of the semester as a means of measuring student progress.

The main limitation of the Test of Economic Understanding for present purposes is that it is quite elementary, being designed primarily for use by secondary school students who may, or may not, have had formal coursework in economics. In other words, it is not designed to be a highly discriminating examination for college students. On the other hand, a modest sample of leading economists who took the examination found it to be quite "good" [2, p. 351].

A second part of the external testing program consisted of 90 four-option multiple-choice questions which comprised the major portion of the final examination for the course. These questions were selected by the author from a list of 387 questions supplied by the Committee for Development of a College-Level Test in Economics [4]. Questions were selected primarily in terms of their relevance to the subject matter content of the course at the University of Nebraska. It must be emphasized that the 90 questions employed had not yet been pretested for reliability and validity nor otherwise empirically evaluated. Hence, the examination does not in any sense reflect the final form of the college-level examination as envisaged by the Committee. The use of these questions rests upon the fact that they were written or endorsed by a distinguished group of economists and educators and specifically prepared for the "typical" college-level principles course.

III. *Comparison Techniques*

A matched-pairs technique was employed in comparing students in the small live (*SL*), large live (*LL*), television (*TV*), and graduate assistant (*GA*) sections. Specifically, students from the *LL*, *TV*, and *GA* sections were matched as closely as possible to the 27 students in the *SL* group on the basis of three criteria. In order of importance these criteria are (1) cumulative grade average, (2) number of semester hours of college work completed, and (3) college affiliation (course of study). The degree of homogeneity achieved among the four groups was very high (Table 1). Per student cumulative grade averages were virtually identical; the range of cumulative hours per student was less than 4 for the four groups; and college affiliation was quite similar.

It is recognized, of course, that other variables—e.g., outside employment, family background, and type of student housing—might well have some bearing upon the performances and attitudes of the four groups. But one can counter that the cumulative grade average used as the basic criterion in the matching process can reasonably be expected to reflect the influence of these other variables. Furthermore, if unconsidered variables are of crucial importance, the relative homogeneity of the four groups in terms of the criteria employed would seem to constitute a prima facie case that such variables would influence the performances and attitudes of the four groups in the same general direction.

IV. *Student Performance*

Mean scores and standard deviations were computed for the four groups on the internal testing program and its three component parts (Table 2). The mean score of the television group was approximately

TABLE 1

CHARACTERISTICS OF THE FOUR MATCHED-PAIRS GROUPS

Method of Instruction	Cumulative Grade Average per Student*	Cumulative Credit Hours per Student	College Affiliation: Number of students					
			Business Administration	Arts and Sciences	Engineering	Agriculture	Teachers	Other†
Small live (SL)	2.644	48.9	7	7	4	5	3	1
Large live (LL)	2.652	51.3	8	7	3	2	6	1
Television (TV)	2.648	47.9	6	5	6	6	2	2
Graduate assistants (GA)	2.640	46.9	6	4	8	3	5	1

* Based on a scale where (A) 4 is the highest and (F) 0 is the lowest grade.
† Pharmacy, home economics, and unclassified.

TABLE 2

MEAN SCORES AND STANDARD DEVIATIONS: INTERNAL TESTING PROGRAM

Internal Testing Program	Small Live (SL)		Large Live (LL)		Television (TV)		Graduate Assistants (GA)	
	Mean Score	S.D.	Mean Score	S.D.	Mean Score	S.D.	Mean Score	S.D.
Total (170 questions)	109.407	23.262	109.667	24.500	112.148	25.352	103.778	25.381
Factual component (46 questions)	31.704	6.574	30.963	7.112	31.074	6.967	29.074	7.157
Conceptual component (57 questions)	34.333	8.185	35.259	8.847	36.185	8.718	32.926	9.123
Analytical component (67 questions)	43.370	9.849	43.444	10.188	44.889	11.036	41.778	10.386

2.5 points higher than either live group and over 8 points higher than the group taught by graduate assistants. However, all possible comparisons of computed "t" values for the mean differences of the four groups on the internal testing program were computed (Table 3) and none was found to be significant at either the .01 or .05 level. Furthermore, there were no statistically significant differences in the mean scores of the four groups on the three components (factual, conceptual, and analytical) of the internal testing program. That is, there were no significant differences among the four groups in comprehending different kinds of subject matter.

The same procedure was followed with respect to the external testing program. The mean scores and standard deviations of the four groups on the college-level test, on Forms A and B of the Test of Economic Understanding, and on the increase in the mean score on the two forms of the Test of Economic Understanding were all computed (Table 4). All possible comparisons of computed "t" values for the mean differences of the four groups on the external testing program were computed (Table 5). None of these "t" values were found to be statistically significant at either the .01 or .05 level.

V. *Student Attitudes*

The second major aspect of this experiment deals with student attitudes toward economics as a course of study or discipline and the method of instruction. Attitudinal data were sought on the assumption that performance data alone are not sufficient in deciding which method of instruction is optimal. For example, other things being equal, a statistically valid conclusion that students perform at substantially the same level regardless of instructional method would suggest that larger colleges and universities should consider carefully the use of televised instruction because of the potential cost economies such instruction would yield [9]. However, if student attitudes toward the discipline or the method of instruction per se were significantly less favorable for the television group as compared to other means of instruction, then it might be quite rational to favor some form of nontelevised instruction.

The accurate measurement of attitudes is subject to many well-known difficulties. In particular, it is difficult to generalize beyond the particular institution involved when measuring student attitudes toward any course or discipline. Student attitudes are clearly a function of such variables as course content, level of analysis, instructor effectiveness, and so forth. However, recalling that the television, large live, and small live sections were virtually identical in these characteristics, one can reasonably assert that important differences in student attitudes reflect in large measure differences in class organization. The

TABLE 3

COMPUTED "t" VALUES AND THEIR SIGNIFICANCE: INTERNAL TESTING PROGRAM

	Total Internal Test			Analytical Component			Conceptual Component			Factual Component		
	LL	TV	GA	LL	TV	GA	LL	TV	GA	LL	TV	GA
Small live..........	0.039876	0.413909	−0.849673	0.027165	0.533425	−0.578139	0.399168	0.804666	−0.596665	−0.397430	−0.341553	−1.406019
Large live.........		0.365732	−0.867428		0.499715	−0.595258		0.387353	−0.954044		0.057996	−0.972772
Television.........			−1.212413			−1.066715			−1.342119			−1.040487

TABLE 4

MEAN SCORES AND STANDARD DEVIATIONS: EXTERNAL TESTING PROGRAM

External Testing Program	Small Live (SL)		Large Live (LL)		Television (TV)		Graduate Assistants (GA)	
	Mean Score	S.D.	Mean Score	S.D.	Mean Score	S.D.	Mean Score	S.D.
Test of Economic Understanding: Form A (50 questions)..	33.889	4.964	35.037	5.104	35.296	6.747	34.074	4.787
Test of Economic Understanding: Form B (50 questions)..	39.074	6.125	38.741	5.933	39.630	7.050	37.296	6.509
Form B minus Form A......	5.185	4.105	3.704	4.530	4.333	5.498	3.222	3.401
College-Level Test (90 questions).............	53.296	11.569	55.259	10.578	54.815	13.241	52.259	11.319

TABLE 5

COMPUTED "t" VALUES AND THEIR SIGNIFICANCE: EXTERNAL TESTING PROGRAM

	TEU-Form A			TEU-Form B			Form B Minus Form A			College-Level Test		
	LL	TV	GA	LL	TV	GA	LL	TV	GA	LL	TV	GA
Small live.........	0.834885	0.873055	0.139528	−0.202662	0.308528	−1.031428	−1.259211	−0.645103	−1.913530	0.650679	0.448765	−0.332941
Large live.........		0.158825	−0.712351		0.501261	0.852188		0.459229	−0.441661		−0.136271	−1.006196
Television.........			−0.767666			−1.263535			−0.893056			−0.762316

graduate assistant sections are obviously less comparable to the other sections because of differences in instructors.

Two short attitude surveys were prepared and administered at the end of the course. The first set of six statements bore directly upon student attitudes towards the course and economics as a discipline or area of study. The second group of five statements were more specific in that they were concerned with the method or technique of instruction per se. Each survey consisted of a series of statements and each student was asked to indicate whether he "strongly agreed" (*SA*), "agreed" (*A*), was "undecided or neutral" (*U*), "disagreed" (*D*), or "strongly disagreed" (*SD*) with each statement. Both attitude surveys took the form of rating scales and arbitrary, but reasonable, numerical weights were assigned to the possible responses to each question as measures of attitude intensity. Actual assigned weights varied from 5 ("strongly agree") to 1 ("strongly disagree") on all positive statements. These numercial weights were reversed on all negative statements. This weighting system allowed for the determination of a numerical score for each respondent on each set of questions. Given six questions in the first attitude survey, possible scores could range from 6 to 30. On the second survey of only five questions scores could range from 5 to 25. High scores indicate favorable attitudes toward the course and teaching technique, while low scores indicate unfavorable attitudes.

The two surveys employed in this study were developed from somewhat lengthier surveys which were administered to a group of 60 princiciples of economics students in the summer of 1966. On the basis of this pretesting, correlation coefficients were run between the numerical value of the response to each individual statement and the total numerical score on each attitude survey. Individual statements whose correlation with the total score was low were eliminated in constructing the revised survey used in this study. It is recognized, of course, that the two sets of questions are not completely independent; one's attitude toward the subject matter in a course may be influenced by the method of instruction and vice versa.

Table 6 lists the set of six statements which comprise the survey of student attitudes toward the subject matter or course. The absolute number of responses to each question are shown by the top figure for the four groups; the bottom figures show these responses as percentages. Mean scores and standard deviations are shown at the bottom of the table. These data indicate that students in the large live section were most favorably disposed towards economics as a discipline, but were closely followed by the small live group. The television group was least favorably disposed towards the course. '

Corresponding data concerning student attitudes toward the method

TABLE 6

STUDENT ATTITUDES TOWARD COURSE: MEAN SCORES AND STANDARD DEVIATIONS

Attitude Statements: Course	Small Live (SL)					Large Live (LL)					Television (TV)					Graduate Assistants (GA)				
	SA	A	U	D	SD	SA	A	U	D	SD	SA	A	U	D	SD	SA	A	U	D	SD
1. Principles of economics should be required of all college students.	3 / 11.1	16 / 59.3	3 / 11.1	4 / 14.8	1 / 3.7	7 / 25.9	14 / 51.9	2 / 7.4	3 / 11.1	1 / 3.7	4 / 14.8	11 / 40.7	3 / 11.1	7 / 25.9	2 / 7.4	6 / 22.2	13 / 48.1	3 / 11.1	4 / 14.8	1 / 3.7
2. As compared to other subject matter areas, I would not rate economics as an important discipline or area of study.	0 / 0	2 / 7.4	4 / 14.8	14 / 51.9	7 / 25.9	0 / 0	1 / 3.7	2 / 7.4	16 / 59.3	8 / 29.6	0 / 0	2 / 7.4	3 / 11.1	17 / 63.0	5 / 18.5	1 / 3.7	1 / 3.7	3 / 11.1	16 / 57.3	6 / 22.2
3. On the basis of my experience in principles of economics I would be inclined to enroll in additional economics courses.	4 / 14.8	15 / 55.6	5 / 18.5	1 / 3.7	2 / 7.4	7 / 25.9	11 / 40.7	4 / 14.8	4 / 14.8	1 / 3.7	2 / 7.4	11 / 40.7	8 / 29.6	5 / 18.5	1 / 3.7	7 / 25.9	7 / 25.9	3 / 11.1	10 / 37.0	0 / 0
4. On the basis of my experience in principles of economics, I would not recommend the course to fellow students.	1 / 3.7	2 / 7.4	1 / 3.7	14 / 51.9	9 / 33.3	2 / 7.4	2 / 7.4	2 / 7.4	13 / 48.1	10 / 37.0	2 / 7.4	2 / 7.4	5 / 18.5	6 / 22.3	12 / 44.4	0 / 0	4 / 14.8	5 / 18.5	9 / 33.3	9 / 33.3
5. The principles of economics course rates high as an overall learning experience.	13 / 48.1	7 / 25.9	4 / 14.8	3 / 11.0	0 / 0	8 / 29.6	13 / 48.1	3 / 11.1	3 / 11.0	0 / 0	6 / 22.2	14 / 51.8	3 / 11.1	2 / 7.4	2 / 7.4	6 / 22.2	11 / 40.7	5 / 18.5	4 / 14.8	1 / 3.7
6. As compared to other courses I have taken at the University, the quality of the content of principles of economics rates low.	0 / 0	1 / 3.7	1 / 3.7	13 / 48.1	12 / 44.4	0 / 0	0 / 0	1 / 3.7	12 / 44.4	14 / 51.9	1 / 3.7	4 / 14.8	1 / 3.7	17 / 63.0	4 / 14.8	0 / 0	2 / 7.4	2 / 7.4	16 / 59.3	7 / 25.9
Mean score...............	23.704					24.148					21.852					22.259				
Standard deviation........	4.322					3.780					4.321					4.460				

TABLE 7

STUDENT ATTITUDES TOWARD METHOD OF INSTRUCTION: MEAN SCORES AND STANDARD DEVIATIONS

Attitude Statements: Method of Instruction	Small Live (SL)					Large Live (LL)					Television (TV)					Graduate Assistants (GA)				
	SA	A	U	D	SD	SA	A	U	D	SD	SA	A	U	D	SD	SA	A	U	D	SD
1. I liked the method by which principles of economics was taught this semester.	12 44.4	12 44.4	1 3.7	2 7.4	0 0	12 44.4	8 29.6	3 11.1	3 11.1	1 3.7	0 0	6 22.2	8 29.6	8 29.6	5 18.5	2 7.4	11 40.7	6 22.2	4 14.8	4 14.8
2. I would have liked to have asked more questions in this course.	4 14.8	7 25.9	11 40.7	5 18.5	— 0	2 7.4	7 25.9	13 48.1	5 18.5	0 0	7 25.9	12 44.4	2 7.4	5 18.5	1 3.7	0 0	5 18.5	14 51.9	6 22.2	2 7.4
3. As compared to other courses which I have had at the University, principles of economics was effectively taught.	11 40.7	14 51.9	1 3.7	1 3.7	— —	8 29.6	16 59.3	2 7.4	1 3.7	0 0	1 3.7	12 44.4	4 14.8	6 22.2	4 14.8	2 7.4	13 48.1	6 22.2	5 18.5	1 3.7
4. I found it difficult to concentrate on the lectures in this course.	0 0	6 22.2	4 14.8	16 59.3	1 3.7	4 14.8	7 25.9	2 7.4	10 37.0	4 14.8	6 22.2	9 33.3	4 14.8	7 25.9	1 3.7	3 11.1	5 18.5	3 11.1	11 40.7	5 18.5
5. I would have liked to have had more personal contact and discussion with the instructor in this course.	3 11.1	12 44.4	7 25.9	4 14.8	1 3.7	2 7.4	15 55.6	6 22.2	4 14.8	0 0	9 33.3	9 33.3	3 11.1	6 22.2	0 0	1 3.7	5 18.5	10 37.0	9 33.3	2 7.4
Mean score............ Standard deviation........	17.185 3.126					16.481 2.966					12.630 3.963					15.667 3.442				

TABLE 8

COMPUTED "t" VALUES AND THEIR SIGNIFICANCE: ATTITUDES

	Attitude toward Course			Attitude toward Method of Instruction		
	LL	TV	GA	LL	TV	GA
Small live..	0.402249	−1.574522	−1.208514	−0.848521	−4.689832†	−1.697027
Large live..		−2.078507*	−1.678894		−4.043458†	−0.931837
Television..			0.340903			3.006583†

* Significant at .05 level
† Significant at .01 level

of instruction are contained in Table 7. In this instance the small live group was the most favorably disposed, followed rather closely by the large live and graduate assistant groups, respectively. The mean score for the television group was substantially below that of the other three groups.

All possible comparisons of computed "t" values for the mean differences of the four groups on the two attitude surveys were computed (Table 8). Concerning student attitudes toward the course, none of these mean differences was found to be significant. The only exception was that the attitude of the television group was less favorable to a statistically significant degree in comparison to the large live group.

Student attitudes toward the method of instruction present a more pronounced picture. Students clearly preferred small live, large live, and graduate assistant instruction to television instruction. These mean differences were all statistically significant at the .01 level. On the other hand, differences in the mean scores for the relevant comparisons of the small live, large live, and graduate assistant groups were not statistically significant.

Table 7 suggests some of the reasons why students are not favorably disposed toward televised instruction. The responses to attitude statements 2 and 5 reflect the absence of direct question-and-answer and classroom discussion in the particular television arrangement used at Nebraska. In addition to putting students in a very passive position one might speculate that students generally resent televised instruction because it constitutes an apparent part of the trend toward "depersonalization" of higher education.[2]

[2] Beyond the evaluative statements of Table 7 students in the four groups were asked to respond to this direct question: "If you were to take the sequel to this course next semester, would you prefer to take the course by television or regular classroom?" Ninety-four (87 percent) of the 108 total students in the four groups responded "regular classroom," while only 14 (13 percent) answered "television." Interestingly enough, however, 7 of the 14 who answered "television" were students in the television group. Hence, despite the overall unfavorable attitude of the television group toward television as a method of instruction, about 25 percent of the television group—a figure substantially higher than for any of the other three groups—expressed a preference for continuing televised instruction in economics.

VI. *Second Run Results*

On a second computer run students were matched using their scores on Form A of the Test of Economic Understanding rather than cumulative grade average as the primary criterion. The results were virtually identical with those just described. There were no significant differences in performances or attitudes toward the course among the four groups. But the television group in comparison to all of the other three groups was decidedly less favorably disposed toward its method of instruction.

VII. *Conclusions, Qualifications, and Implications*

Conclusions. The foregoing data suggest that the following conclusions are warranted:

1. On the basis of intensive objective testing, employing both examinations prepared as a component of the course and examinations prepared by experts disassociated from the course, no statistically significant differences were found in the performances of students in the four groups. This conclusion applies, not only to total performance on the internal testing program, but also to the analytical, conceptual, and factual components of that program. Generally, the mean scores of the television group were higher than the scores of the other three groups, but not to the extent that the mean differences were significant statistically.

2. There were no significant differences among the small live, large live, and graduate assistant groups with respect to their attitudes toward the course (discipline). However, the television group was less favorably disposed toward the course in comparison to the large live group to an extent significant at the .05 level. The mean differences of the attitude scores of the television group in comparison with the small live and graduate assistant groups were not statistically significant.

3. In comparison to each of the other three groups the television group was less favorably disposed toward its method of instruction to an extent statistically significant at the .01 level. Comparisons of preferences among the other three groups revealed no statistically significant differences in mean scores.

Qualifications. The foregoing data and the conclusions derived therefrom are envisioned as the results of a single case study. Admittedly, another instructor at another institution might obtain conflicting results from a similar experiment. However, although no attempt is made to generalize beyond the confines of the University of Nebraska, several observations should be made. First, students at the University are probably quite typical of students in principles of economics courses at a large number of American colleges and universities. Furthermore,

the principles course at Nebraska is quite standard as to subject matter, type and level of presentation, textbook and supplementary materials, etc. It would, therefore, not be too surprising if similar experiments at other institutions would yield roughly comparable results.

There is one problem inherent in the present study which merits explicit comment: the author taught the small live, large live, and television groups. Hence, one might raise the criticism that the results of the study may be of limited applicability in that they reflect the relative competence of one individual teaching in three substantially different classroom situations. There is perhaps no real defense for this criticism other than to point out that the approach employed does have the distinct advantage of holding the instructor "constant." That is, comparisons of the performances and attitudes of small live, large live, and television groups taught by three different instructors might yield conclusions subject to even more severe constraints.

Implications. What does all of this imply with respect to the teaching of principles of economics?

First, given the unfavorable attitudes of students toward televised instruction and the assumption that some priority should be attached to student preferences, television instruction unmodified by "live" discussion time at the end of each televised lecture or at separate hours is perhaps inadvisable. A semi-televised course involving, for example, two 50-minute televised lectures and one live discussion session per week or the use of three 30-minute televised lectures per week each followed by 20 minutes of discussion and questions might have resulted in more favorable student attitudes toward television as a method of instruction. But a dilemma certainly exists in the use of television as a method of instruction. Cost economies are likely to be greatest when television is used to the fullest extent possible. As Paden [9, p. 30] has noted, "Television, in conjunction with videotape, is seen as a replicative device par excellence." Yet the fullest exploitation of these cost economies may well induce unfavorable student attitudes toward this method of instruction and perhaps also toward economics as a discipline.

A second implication is that, given current staffing problems and burgeoning enrollments, the widespread and increasing use of graduate teaching assistants might be a highly defensible practice in terms of both instructional quality and student attitudes.[3] Neither student performance nor attitudes compared unfavorably at a statistically signifi-

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[3] The graduate assistant group was perhaps at a disadvantage with respect to the internal testing program because their classroom instructors played no role in the preparation of these examinations. Furthermore, while the SL, LL, and TV groups were all on a Monday-Wednesday-Friday class sequence, the three sections from which the GA matched-pairs group was selected were on a Tuesday-Thursday-Saturday sequence; hence, on each of the three-hour examinations which constituted the bulk of the internal testing program, the GA group has the benefit of one less class lecture.

cant level with any of the other three groups. Indeed, one of the more subtle disadvantages of unmodified televised instruction is that it eliminates the basic means by which predoctorate students can acquire teaching experience under supervised conditions.

REFERENCES

1. Richard Attiyeh and Keith Lumsden, "The Effectiveness of 'Programmed Learning' in Economics," *A. E. R.*, May, 1965, pp. 549–55.
2. G. L. Bach and Phillip Saunders, "Economic Education: Aspirations and Achievements," *A. E. R.*, June, 1965, pp. 329–55.
3. R. Fels and D. R. Starleaf, "Controlled Experiments in Teaching Techniques," *So. Econ. J.*, July, 1963, pp. 68–73.
4. Rendigs Fels, "A New 'Test of Understanding in College Economics,'" *A. E. R.*, May, 1967, pp. 660–66.
5. D. R. Fusfeld and Gregory Jump, "An Experiment with Programmed Instruction in Economics," *So. Econ. J.*, Jan., 1966, pp. 353–56.
6. Bernard F. Haley, *Experiments in the Teaching of Basic Economics* (Joint Council on Econ. Educa., 1966).
7. C. R. McConnell and J. R. Felton, "A Controlled Evaluation of 'The American Economy,'" *A. E. R.*, June, 1964, pp. 403–07.
8. W. B. Nelson, "An Experiment with Class Size in the Teaching of Economics," *The Educational Record*, Oct., 1959, pp. 338–41.
9. Donald W. Paden, "The Teaching of Economics by Television," *Quar. Rev. of Econ. and Bus.*, Nov., 1962, pp. 29–39.
10. Phillip Saunders, "The Effectiveness of 'The American Economy' in Training Secondary School Teachers," *A. E. R.*, June, 1964, pp. 396–403.
11. Simon N. Whitney, "Measuring the Success of the Elementary Course," *A. E. R.*, Mar., 1960, pp. 159–69.

DISCUSSION

MYRON L. JOSEPH: We should be grateful that Professor Kelley was trapped into presenting this preliminary report on the first stages of an interesting and promising experiment. It would therefore be an ungrateful quibble to dwell on the gaps between the evidence, taken mostly from a student survey, and some of the overly optimistic conclusions in the paper. Instead we should be prepared to learn from what I am sure will be a fruitful experiment—one that could easily have been the response of a frustrated course chairman or department head to long-standing and well-founded student complaints. Students should be able to identify the key areas for which they will be held responsible, they should get feedback that will permit them to assess how well they are absorbing the course material, and they should get suggestions and help from their instructors that will help them correct inadequacies and improve learning. The TIPS program is designed to satisfy these needs, whereas each step in a programmed instruction system attempts to give immediate and specific feedback on a very narrowly defined subject. TIPS is designed to give more general direction related to a broader segment of course content based on a sample of student performance.

The idea is as old as teaching. The old-fashioned way was to combine weekly quizzes, homework problems, and the continuous interaction of the classroom to provide feedback and direction. The students were expected to assume the burden of evaluating their own progress in the light of these signals and to ask for help if it was needed. Above-average students could ply the instructor with embarrassing questions and be rewarded with extra reading, more challenging assignments, and personal stimulation. The effectiveness of this system depended on high student and teacher motivation, on the student's ability to read the signals properly, and on the teacher's ability to diagnose the situation and suggest the proper remedies.

Deep in our hearts we all know we are excellent teachers, and we can explain away all of the evidence to the contrary. But it is painfully true that in too many instances the old-fashioned system has degenerated to midsemester and final exams, plus one or two quizzes or assignments to provide all of the information for student and teacher. The TIPS system may fill the gap. It amounts to a computer simulation of one aspect of a master teacher. The process of designing the system will force the "teacher" to identify the concepts to be covered, to select effective instruments to test understanding of these concepts, and to provide a range of assignments that are responsive to different levels and patterns of student learning. When the system is completed it should give students the kind of feedback and direction they need, but of possibly greater importance will be the formal and careful attention to the actual elements of the teaching process that will be required before TIPS will be effective.

Professor Kelley's preliminary report suggests that there is a real danger that these basic elements will not receive adequate attention. The paper

reports no serious attempts to test the adequacy of the surveys, or to evaluate alternative instruments. The TIPS system requires that the surveys take an accurate sample of the student's knowledge in key areas. But over 37 percent of the students reported (as first or second choice) that "the surveys did not reflect my knowledge of the material and thus gave me a false sense of confidence in some areas." Only 6.5 percent of the students thought the surveys were a "very good" indicator and only 50 percent thought they were a "good" indicator of their knowledge of the course. Over 45 percent of the students admitted that they guessed at about 25 percent or more of the survey questions because of lack of time. Student opinion is not a reasonable or reliable way to validate the survey questions, but the student responses reported by Professor Kelley suggest that the task of instrument design is far from over.

The fact that the surveys contributed "slightly more to the prediction of the second examination score than even the first formal examination" tells us nothing about their ability to measure knowledge of the covered concepts. Any number of alternative simple or complex relationships could explain the correlation. Indeed, it could be argued that if the students who did poorly on the surveys were in the same relative position on the exam, either the surveys failed to identify the areas in which their knowledge was inadequate or the individualized assignments were useless. Professor Kelley reports that a comprehensive bank of questions and problems is under development as a means of economizing on scarce professorial time. Since the effectiveness of TIPS will depend in large part on the validity of the surveys, I would urge that consideration be given to a comparative evaluation of survey instruments before they are built into the next stages of the TIPS experiment.

Similarly, the research design should permit an evaluation of different patterns of assignment response to survey results, with heavy emphasis on the generation of objective data on student behavior and learning. Unfortunately, the initial experiment provided only optional or required problem sets, depending on student performance, and there was no objective data on the impact of this differential assignment pattern. Presumably because the initial stages of the work concentrated on system design rather than evaluation, the computer potential was not utilized and students were asked to remember what percent of their problems were optional, how many of the optional problems they turned in, and what they did with their spare time. In the absence of comparative time reports from a control group and without any information on how the required problems were treated by students and instructors, it is difficult to interpret the responses. Evidently few students thought they were able to make good use of the time saved, which suggests that the estimates of how much time was freed and how it was spent should be given little weight.

The initial experiment should underline the importance of objective data and of controlling for the behavior of the teachers. This initial report gives us no information at all about the role of the teachers and their response to TIPS. We do not know, for example, whether the surveys were given

before or after the material was covered in lecture or individual sections, and without that information we cannot evaluate the reported "increased tendency to do the assigned readings before the material was covered in class or section." We do not know if instructors substituted the surveys for short quizzes, if they reacted to the reported results, or if they utilized TIPS in any way. The report notes that thus far "released time" from reduced grading offsets additional time on tutorials and paper supervision, but that was evidently not tested in the pilot project since the programs capabilities for providing a variety of teaching instruments were not used. Controlling for teacher behavior will be a most difficult but critical element in future experiments.

Evaluation of the system as it develops will depend largely on careful experimental design and on the substitution of objective data for student memory and opinion. The students have given TIPS a vote of confidence by recommending its continued use overwhelmingly and by selecting as its most important benefits the specific functions of the surveys: identifying areas of weakness, indicating key concepts and areas of importance, and encouraging learning. There is no comparable endorsement of the differential assignments, since the students were not asked if they benefited from the required problem sets, and we have only the statements that the free time saved by having optional assignments was not of particular importance. If the survey instruments and the feedback patterns are treated as research subjects, TIPS could develop into a valuable tool with wide application. If it is installed too rapidly, it could simply computerize our untested beliefs and bad habits.

One final quibble. Although TIPS represents an imaginative step forward, it makes only modest use of computer potential and intrudes only slightly into the traditional teaching pattern. This may be designed to make haste slowly and to avoid faculty rebellion, but why shouldn't planning for TIPS include feedback of explanations for incorrect survey responses as well as individualized reading assignments; comparable problem sets so that students can check their learning on their own after they have done the remedial work; or a time-sharing system that enables the students to obtain survey questions and assignment feedback from the computer at their convenience?

A major strength of the TIPS approach is that it picks up a substantial part of the burden of transferring specific knowledge, and potentially, at least, will free more class time for concentration on the application of economic analysis to socioeconomic problems. Its development will, as Professor Kelley indicates, provide rewarding research opportunities for economists concerned with education, but I hope they will remember why they wanted the new tool.

RICHARD S. BOWER: I remember the lyrics, "It ain't what you do, it's the way that you do it, that's what gets results." The words describe what we are looking for as teachers of economics: "A way to do it." Attiyeh, Brainard, and Dolbear, in their report on Stanford's macroecnonmic policy

simulation, suggest that gaming may make a good macroeconomics course better. Experience at Dartmouth suggests that gaming using a time-sharing computer may make a good course much better.

The Stanford simulation is a worthwhile teaching experiment. Since it is an experiment, however, it does prompt questions.

Is fun enough to make a game successful? The game of FOOTBALL is often played by users of Dartmouth's time-sharing computer system. The user becomes Dartmouth's quarterback against Princeton and is an active decision-maker who gets continuous feedback and applies accumulating knowledge to a variety of different situations. He has fun but he doesn't learn very much because not much is asked of him. It is probable that the same may be said about participants in the Stanford macroeconomic game. They have fun and learn something when they set values for policy variables in an effort to achieve output, employment, and price targets. But wouldn't they learn a great deal more if they were forced to formulate their analysis, make their model explicit, and provide numerical estimates of relevant relationships? The twenty quarters of history could be the basis for an initial model building assignment. Succeeding quarters would then permit revision and reestimation. With an explicit model and a derived table of multipliers students should learn more from analysis than they ever could from errors such as confusing tax-income causality or ignoring the impact of exogenous investment. They still will make mistakes, but they will be in a position to learn a lot more from them.

Can change of a parameter during the game adversely affect the learning experience? During the twenty quarters of history in the Stanford game the net national product-interest rate-investment relationship caused increases in net national product to induce decreases in investment. As a result the tax to net national product multiplier was about 1.5. For the twenty-first quarter, the first period which demanded a tax policy decision, the roles of interest rate and money supply as endogenous and exogenous variables were reversed, and the tax to net national product multiplier was doubled. This change could have made analytic effort seem unrewarding and, as a result, might have frustrated students and hurt the learning experience.

There is unfortunately insufficient time to discuss other questions, because I do want to note what a time-sharing computer can contribute to gaming and to macroeconomics courses.

Several problems arise when a macroeconomic game is played on a conventional computer. Writing, testing, and adjusting the simulation itself is difficult and suffers from slow turn around time and limitations on man-machine interaction. Feedback may take a day or more. Students with different talents and needs follow the same sequence of decisions and the same time schedule even though they play against the system and not against each other. Ability to model and estimate is limited by lack of high-speed calculating devices. The student cannot take the initiative in getting more observations or expanding his experience with policy decisions. These problems disappear when the game is shifted to a time-sharing computer.

A time-sharing computer, such as the General Electric 635 at Dartmouth, will permit more than 100 users to write, list and run programs simultaneously from remote teletype terminals on line to the central processing unit. Working from one of these terminals and writing in the user-oriented language BASIC it took me about two hours to put the Stanford macroeconomic game on the Dartmouth system. Modifying the game, testing the modifications, and searching for sensitivity to inputs or parameters takes only minutes and can be done from a portable terminal in your own office. Each student with access to the simulation program in "Run Only," can enter decisions when ready and can get results immediately. A student can proceed at his own pace, and the program can be written so he can select his own problem situations. He can also replay situations. If he wants to estimate relationships, he has access to a multiple regression program. With time-sharing, each student helps to structure his own learning experience. The teacher's responsibility shifts from running a game to creating a game environment which can satisfy individual educational needs.

In the past we have encouraged students to fit relationships and do their own simulations in our macroeconomic course. Our plans for this year may suggest the opportunities time-sharing provides. Early in the course students will be provided a "Run Only" simulation based on the Stanford model. They will be able to manipulate variables in order to generate the history they need for estimating the model. Each student, having submitted his model as one assignment, will be asked to apply it in a series of policy decisions. Several of these decisions will be discussed in class using terminals to show how decisions might work out if parameters of the model were altered. Later, half the students will be asked to write estimation-decision programs that derive relationships from observations and provide values for policy variables. Meanwhile, the remaining students will fit component equations for a model of the American economy using a data bank of aggregates accessible in time-sharing by programs which permit transformation and regression. The final exercise should apply the first group's estimation-decision programs to simulation output from the second group's equations. This is an ambitious plan, but it is possible since time-sharing makes computer power readily accessible to faculty and students.

Macroeconomic gaming using time-sharing offers a wide range of exciting possibilities for more effective teaching. But there are problems. One is that students think they have learned about the world when what they have really learned is how to estimate relationships and act on their estimates. A second is that games, like programmed instruction and unlike live teachers, put fairly narrow limits on the structure of student response and students grow to dislike this. A third is that gaming is likely to become a competitive weapon in the faculty battle for student time, and four games a semester may be worse than none at all.

Problems can be solved or avoided and none are so serious that they should discourage continuation of the experiment so well begun at Stanford.

HENRY H. VILLARD: Professor McConnell's results are easily summarized. First, McConnell on television, McConnell in a large lecture, McConnell in

a small section, and graduate students in small sections are effective in conveying understanding of the contents of a typical introductory economics course in the order named, but the differences in effectiveness are statistically insignificant. Second, students have a statistically significant preference for any form of live instruction in place of television. For what it's worth, I offer as an explanation of the differences, even though statistically insignificant, in the effectiveness of the four methods, the thought that the less a student can ask questions, the more effective will the technique be in conveying a body of knowledge, for in any carefully worked out presentation, most questions are likely to reflect, not lack of comprehension of the material, but rather concern with its relevance to reality—and therefore reduce the effectiveness of the learning process. Let me return to this matter of content a little later.

Though he himself does not go so far, Professor McConnell's results offer the prospect of a brave new world. Already the State University of New York has a ten-channel television monitor in class and public rooms throughout its colleges, which offers the possibility of a student dropping in to "catch" a lecture at any time he wishes. But this surely does not exhaust the technical possibilities: it should soon be possible to arrange for a student to view the lectures of an entire course as the spirit moves him, with instant playback and a speed control to permit skimming dull passages, and slowing down difficult ones. It all seems a heady prospect in a world in which students want increasingly to control their own fate.

But let us not forget the obviously apocryphal story of the British educators who examined our television teaching aids and returned home to start the Basic Orderly Organization of Knowledge Society—known for short as BOOKS. For what Professor McConnell did not test is what would have happened if he had arranged to have his television lectures transcribed, printed, and given to students—who would then have had a 24-hour availability, instant playback, and the ability to speed up or slow down without the need for any technical apparatus whatsoever.

The question I am raising deals, as I see it, with the nature of the learning process, about which I submit we know very little indeed. But I do not believe we need to be ashamed of our ignorance, as a recent study by Professor Jeanne S. Chall makes clear that educators know practically nothing about how students learn to read, which does seem a trifle more basic than how they learn economics. Obviously this is a matter which needs to be researched, but I would be less than candid with you if I did not admit my doubt that research would do much good. For Professor Chall reports that, among the hundreds of teachers and school administrators she interviewed over a period of four years, she was unable to find one willing to admit making a change in teaching methods because of the results of the findings of research! What this reflects, as I see it, is that even those of us who have not had the benefit of courses on teaching methods in schools of education have no doubt whatsoever regarding our ability to teach in the most effective possible manner.

Actually our problem is considerably more difficult than teaching read-

ing, which boils down, in obvious oversimplification, to a debate as to whether the specific skill involved in reading can best be learned by stressing the alphabet or meaning. Our problem, on the other hand, involves not merely the relative merits of types of reading—regular texts versus transcribed lectures versus programmed learning—but also the relative merits of a variety of presentations for the student to hear or to hear and see. One does not have to go as far as Huxley's suggestion in *Brave New World* that in time all learning may be conveyed by pillow speakers or to the possibility that knowledge may be conveyed subliminally while the student consciously watches a Western to realize the many alternatives available to us.

As an immediate first step I urge Professor McConnell to have his lectures transcribed and to pit his printed words against himself on the television screen. (What this suggestion implies about the readability of our usual texts I leave to others to point out.) But certainly Gresham's law should be allowed to work if cheaper reading is as effective as expensive television. Actually I do not believe that our choice is likely to be "either/ or." Rather I suggest that further research will demonstrate that both reading and viewing are needed. For it seems quite likely that there are wide differences in the relative ability of individuals to comprehend a body of material by either technique. Hence my second suggestion to Professor McConnell is that, after he has established norms for each half of his course, he then have students read half and view the remainder—or vice versa. Presumably the results for each group taken as a whole will merely confirm the results of the first test as to the relative merits of the two basic techniques. But the second experiment should enable us to determine whether individual students vary significantly in their ability to learn by the two methods. If variations do in fact turn out to be as significant as I suspect them to be, then soon each student may be tested on entering college to decide whether he is a reader or a viewer. If found to be the latter, he will then be allowed to learn at least elementary material from films rather than books. Note that, assuming significant variations, it should be possible to let viewers benefit from programmed learning by simply televising the learning program—provided only that, as already suggested, certain relatively minor technical changes can be made in the mechanics of television transmission. To sum up thus far: while experimenting with teaching techniques is certainly desirable, the ultimate choice among them may well require a far greater understanding of the way in which individuals learn than we now possess.

Now let me turn to the relationship between teaching techniques and content. In the thirty-five years since I started to study economics there has been an immense increase in our analytical tools in general and our mathematic tools in particular. But the time devoted to graduate education has not increased: in fact, many, including the Ford Foundation, are trying hard to reduce the time needed to obtain the Ph.D. As a result, graduate education has increasingly devoted itself to teaching tools, and the thesis has changed from an effort to add to knowledge to a demonstration of

competence in using the tools that have been taught. As a result, as economics is what economists talk about and young economists inevitably talk about what they have been taught, our discipline has become increasingly concerned with tools and techniques of analysis.

This in turn means that when recent graduates, for whom tools are the whole of economics, determine the content of the introductory course, they tend all too frequently to make it into a leg-up for the Ph.D. orals. Perhaps this is of benefit to majors. It certainly pleases refugees from engineering who like precise answers and find the mathematics easy, and it also amuses those who like crossword puzzles, chess, and double-crostics. But it leaves most liberal arts students in general and potential teachers in particular thoroughly convinced that economics is indeed a dismal science. Moreover, though Bach and Saunders have shown that a detooled course greatly increases student interest, a practically continuous battle is required to prevent graduate students and recent graduates from putting back the tools that have been dropped or elaborating in great detail the tools that remain. But the expansion of enrollment, in general, and graduate work, in particular, makes us increasingly depend on graduate students to handle our introductory work.

What especially excited me about Professor McConnell's results—and related evidence that programmed learning can also be used with high effectiveness to convey a body of knowledge—is the contribution they can make to this problem. Suppose, for example, an economics department decides to devote x percent of the introductory course to teaching students necessary tools by televised lectures or programmed learning and y percent to the application of such tools to current economic problems in discussion sections. Obviously the ratio of x to y should depend on the particular circumstances of any given department, but the discussion sections would in any event be relatively small if the saving in faculty time resulting from the television lectures or programmed learning were used to make them small.

I believe three benefits would flow from such an organization of our introductory work. First, provided only that the discussion sections did in fact deal with applications, then the departmental decision regarding the importance of tools would be self-enforcing, and the tendency of recent graduates to demonstrate their erudition regarding tools would be automatically restrained. Second, assuming only that a reasonable amount of time was in fact devoted to applications, then the boredom with televised lectures Professor McConnell's students expressed—and which has also been expressed by students subjected to programmed learning—might well be allayed. For we would, hopefully at least, be able to show why the tools were worth learning.

Third, most important (and most Machiavellian), I suspect that if some of our younger graduates were made to confine themselves to applications— to make like political economists for a change—it just might reduce their estimate of the importance of tools. After all, the desirable tradeoff between the erosion of the living level of those who have retired on fixed incomes and

the amount of teenage unemployment in Harlem is not given by the Phillips curve. Nor does an immense amount of economic knowledge guarantee that even similar—far less identical—tradeoffs will be chosen, as is demonstrated by the vast differences in policy recommendations that economists of comparable professional standing make. In short, I offer the thought that devoting a significant portion of the introductory course explicitly to applications of analysis and solutions of policy problems might well make both economics and economists more relevant—and so make economics significantly less dismal

TECHNOLOGICAL AND ECONOMIC IMPLICATIONS
OF 3 PERCENT GROWTH

TECHNOLOGY FOR SOCIETY

By MICHAEL MICHAELIS
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The industrial revolution, begun in England around 1760, ushered in a new epoch in economic growth. The principal innovation that distinguishes this epoch is the extended application of science and technology to problems of economic production. The first century of this modern epoch was dominated by empirical inventions. But since the mid-nineteenth century, science-based technology has become the major source of economic growth in the developed countries. With every passing decade we have seen increasing evidence that the conscious and systematic application of basic scientific discoveries can substantially advance economic growth and human welfare. My task here is to examine how we may continue to use technical knowledge as the driving force of the economy.

At least one new aspect of technical knowledge has impressed itself on public consciousness: it is increasing at an explosive rate. The possible applications of this tremendous store of facts and learning challenge the imagination. One is tempted to hazard conjectures on the kind of technologies that can become available in the next two or three generations and to deduce their impact on society. These exercises in technical forecasting have indeed become quite fashionable in recent years. At least thirty conferences have been held this year principally devoted to this topic. Technical forecasting takes one into the realm of the "Delphi" technique—a succession of iterative brainstorming rounds in which deliberate attempts are made to reduce the interference of psychological factors such as the "bandwagon" effect. It is an interesting exercise and it leads to forecasts of many technological wonders.[1]   Yet, when I review these forecasts, two thoughts impress themselves on me. Whatever I, or someone better qualified, may prophesy, we can be sure that the predictions will be off the mark. If the experience of the last few decades is any guide, current prognostications can be surpassed and achieved in shorter time than expected. Then again, the revolutionary nature of most of these anticipated discoveries and developments makes it practically impossible to predict their economic consequences in any

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[1] See, e.g., Herman Kahn and Anthony J. Wiener, *The Next 33 Years—A Framework for Speculation* (1967).

traditional manner because they entail totally different patterns of production, consumption, and related institutional behavior.

In short, the word of the prophet may be headline catching, but it is not very productive for my purpose here. It serves, rather, to drive home one crucial lesson: We must exercise utmost responsibility in planning for economic, social and political risk-taking if we are to utilize productively the advanced knowledge that science and technology can provide for the well-being of society. As Peter Drucker said so well: "Innovation is more than a new method. It is a new view of the universe, as one of risk rather than of chance or of certainty. It is a new view of man's role in the universe; he creates order by taking risks. And this means that innovation, rather than being an assertion of human power, is an acceptance of human responsibility."[2]

It is in this spirit that I would like to discuss with you some of the future implications of technological innovation. The question of how important is technology for economic growth has been studied and debated for some time. Kuznets[3] and Denison[4] have shed particularly valuable light on this topic. According to Kuznets, "the inescapable conclusion is that the direct contribution of man-hours and capital accumulation would hardly account for more than a tenth of the rate of growth in per capita product—and probably less. The large remainder must be assigned to an increase in efficiency in the productive resources, due either to the improved quality of the resources, or to the effects of changing arrangements, or to the impact of technological change, or to all three." Denison's analysis of economic growth in the United States during the first half of this century shows that capital and land contributed only about 12 percent. On the other hand, increased education of the labor force and the increased output per unit of input, due largely to economies of scale and spread of technical knowledge, contributed together over 85 percent. Since education and economies of scale are results of additions to and spread of the stock of useful knowledge, the dominant role of the latter in the growth of product per capita is apparent.

Not all of this "unexplained residual," over and above increases in labor and capital output, is technology; i.e., "knowledge that deals with the industrial arts, applied science, engineering."[5] But to the extent that all of it is knowledge-based, one can at least postulate that it must be applications of knowledge, whether they be embodied in industrial processes per se or in management and in education; i.e., in

[2] Peter Drucker, *Landmarks of Tomorrow* (1959).
[3] Simon Kuznets, *Modern Economic Growth* (1966).
[4] Edward F. Denison, *The Sources of Economic Growth in the United States and the Alternatives Before Us* (1962).
[5] *Random House Dictionary* definition.

institutional and human development. Indeed, as I shall emphasize later, the interplay of technological and institutional changes is of the essence in economic growth.

Recognizing then that technological innovation is of prime importance for economic growth, we must ask, how can we keep up, or indeed increase, the rate of technical advance? This, in turn, raises two subquestions: (1) Can we sustain—or increase—the rate of generating new knowledge? (2) Can we sustain—or increase—the rate of applying this knowledge? I have already answered the first question, by previously referring to the explosively growing accumulation of technical knowledge. I will go so far as to make a blunt assertion, realizing that I am oversimplifying for the sake of emphasis. We now have, or know how to get, all the technical knowledge needed to satisfy foreseeable human wants. And we will continue to be in this fortunate situation from here on out—barring cataclysmic catastrophies. Note that I said "technical knowledge," and not "technology." The latter is the state of the industrial arts, markedly inadequate for human needs at any time up to and including the present and far behind the frontiers of knowledge gained through science research.

If my assertion is correct—as I believe it to be—then we can conclude at once that the much debated relationship between science, technology, and economic growth is not governed principally by any lack of research effort; i.e., by shortcomings in generating new knowledge. Rather, the crucial issue is whether and how we can translate this knowledge into application.

At this point let me say that, though I recognize the inherent possibilities of resource limitations—be they physical resources on the one hand or limitation of aggregate demand on the other—I am deliberately passing over these issues in the expectation that my fellow panelists will deal with them explicitly. The aspect of technical innovation that interests me most is the social mechanism needed to translate knowledge into use.

The traditional mechanism has been the market. But, as I shall illustrate later, this response mechanism has so far led more often to haphazard development rather than to systematic application of the full range of available technical knowledge. The shortcomings of our transportation facilities, for instance, is an example frustratingly enough experienced by all of us to require no further documentation on my part.

I have some real doubts, therefore, that the traditional mechanisms alone will be adequate in the future. I am all the more dubious when I scan, on the one hand, the frighteningly powerful technologies suggested by technical forecasts, while I see, on the other hand, the tremendous social and economic problems to be solved in a largely urbanized society.

I believe, therefore, that we may have to consider quite deliberately the possibilities of a social environment that is at variance with the traditional market/private property system—at least in some critical areas—if systems are to be created that can be wholly responsive to needs by employing all available knowledge. On reflection, you may agree that this is not as revolutionary as it might at first appear. For instance, the automobile industry is a "market/private property" institution only to the degree that it functions within an infrastructure, e.g., the road network and oil subsidies, which is largely public financed. What I am suggesting is that we recognize consciously and design coherently an environment to which we are already becoming committed in part, by reason of expediency and special-interest group pressure. In such an environment, business, government, and labor will have to establish a permanent living arrangement with science in which technological innovation becomes an integral part of everyday life.

Such an environment, by and large, does not now exist in the normal business world. Our national and corporate preoccupation with the field of science has served us well in the creation of institutions and machinery for generating new knowledge. The accompanying field of technology has been virtually taken for granted, on the assumption that the mere availability of a new resource—scientific knowledge—would, through the entrepreneurship of industry, lead to new technology coming into being. And so it has, albeit to varying degrees: vastly more so in the state-dominated realms of, say, defense and space exploration than in the life of the civilian market place.

The first official cursory examination of this phenomenon was undertaken by a small White House Advisory Panel in 1961. Several of my colleagues on that panel held that the lesser research and development effort in the civilian industries was the cause for their lack of growth. Though this may be a correct cause-effect analysis, I believe that it begs the real issue: why is less research and development being done in these fields? The inescapable answer is that the "uncertainty" surrounding the pay-off of civilian R and D had not been converted into the kind of "risk" situation with which the traditional business organization and the market place can deal competently. This climate of uncertainty brings with it all the well-known and well-documented resistance to innovation. This resistance is the easier to maintain when it can be defended from bastions of time-honored traditions, beliefs, and myths. If even the military and its apparently fast-moving technical-industrial complex have been accused of fighting any war with the weapons and strategies of the previous one, then we can be sure that our civilian objectives of social and economic progress are hampered by even more antiquated and outmoded ways.

So, here we are: on the one hand, the need to accelerate technological

innovation in order to attain our social and economic goals; on the other hand, resistance to such innovation because of the fear of uncertainty. Hence, the need to convert uncertainty into manageable risk—an innovation in itself—in order to help create the climate conducive to innovation. Finally, the recognition that this climate for technological change requires continuing, and often major, changes in institutional and personal behavior and attitudes and in values and norms traditionally held. If the ancient Heraclitus could say, "You cannot step twice into the same river," the modern Heraclitus must add, "The river cannot twice bathe the same person."

Let me illustrate, with a homely example, some of the conditions I have sketched. Take the problem of keeping clothes clean. Note that this is a basic functional requirement of social man. How does industry respond to this need? Traditionally it first offers various products. The washing machine and the dryer, for instance, help eliminate the physical labor involved, and an appliance industry evolves, bent upon marginal improvements of its products from year to year, principally to enhance their sales appeal, without introducing any drastic innovations. The chemical industry offers the necessary detergents or soaps, the properties of some of which, while excellent for their primary purpose, also create new problems in pollution control. Now comes the textile and clothing industry, spurred by advances in chemical techniques, and brings us crease-resistant materials. As a result, the possibilities for solvent cleaning become more practical; hitherto they had been held back by the housewife's dislike for ironing. Coin-operated, solvent-cleaning establishments spring up. Simultaneously, even newer materials emerge—some are cheaper and offer possibilities for essentially one-wear disposable garments. Entrepreneurs can now step in with a new concept: we will deliver clean clothes to you once a week or however often you wish as a total service. You can pick the style, color, size, and quality. What was only available for babies—the diaper service—can be extended to the adult population. For the first time, the basic functional need is being served by a comprehensive, functional, industrial response. The evolution of the response has taken some thirty years. A $5 billion industry—keeping clothes clean—has been modernized by coupling advancing technology with more or less visionary entrepreneurship. For the same annual cost of about $5 billion, we are simultaneously progressing from the first orbiting satellite to a manned moon landing in about ten years.

One basic difference between space exploration and keeping clothes clean is that the former was treated as a functional whole from the start. A central organization was created with a single overriding mission, and all relevant kinds of technical knowledge were brought to

bear from whatever source. No obstacles—economic, social, or political —were permitted to stand in the way, even though the wisdom of allocating large national resources to this particular crash objective was questioned by some.

On the other hand, the keeping clean of clothes grew in the traditional manner in response to the demands of the market place and is mainly served by products of various industries. This product-orientation of a corporation, with its concomitant investment of slowly amortizing capital resources devoted to established product lines, mitigates against rapid and major technological changes from within that company or even from within its industry sector. It is generally innovations made in other sectors that so change the nature of the market as to force re-active responses, of a technical or economic kind, from all the sectors serving that market. It is mainly by happenstance of entrepreneurial and technical opportunism that a situation develops when one or more corporations can, or will, ultimately respond to the basic functional demand with an integrated system of goods and services based on the full spectrum of advanced technical knowledge available.

The emergence of such a system-oriented, function-minded corporate entity is still rare in our business environment. Some of the computer-based enterprises are getting close. The most notable and really unique example is our telephone system which has evolved in response to the basic functional demands of the market for many decades. It is highly significant, to my way of thinking, that these function-oriented enter-prises also show very rapid rates of technical innovation. The reason is not hard to find.

The corporate society strives for survival, stability, and continuity. Its life is a constant response to threats either to its survival or to its identity. Where its identity is coupled to specific products, as is that of most of our corporations, its survival depends on maintaining the de-mand for these products. Manipulation and stabilization of market demand, as Galbraith suggests, becomes a primary objective—and particularly so for product-oriented corporations, as I see it.

Functional orientation, on the other hand, that is integrated response to society's needs, for, say, telecommunications, transportation, energy, shelter, food and so on, provides an environment where survival depends much more on innovation. By that I mean innovation in all those com-ponents that go to make up the whole integrated system being offered. When the consumer is in a position to "buy" a system fulfilling a basic functional need, whether it now be telecommunications, defense, or space exploration, or perhaps in the not-too-distant future education and health, then he judges the value of his purchase on improved per-formance and lower costs of the whole system's operation. Both can be

achieved in great part by rapid technological innovation, and the conse-quent obsolescence of particular components of the system is of less consequence than the improved functioning of the whole. In short, an environment is created in which innovation becomes more of an exciting prospect for all involved instead of a threat to survival. This, in turn, creates and maintains the demand for unusually imaginative manage-ment, engineering, and labor—a notable feature of function-oriented corporations. Hence, most importantly, in such an environment de-liberate efforts can and are continuously being made to ease the impact of innovation—of transition—on those most affected, be they consumers, workers, or managers. In other words, a function-directed institution seems to exhibit greater ability to act by anticipation rather than by reaction.

I believe, therefore, that the more that function-orientation can determine the objectives and behavior of our business and govern-mental institutions, the more opportunity will occur for technology to be used to the fullest extent in pursuit of economic and social well-being. Major changes in human and institutional attitudes are therefore needed if this prerequisite condition for innovation is to be fulfilled. The rate of technological innovation achievable in practice is directly related to human values.

Kenneth Boulding has described most thoughtfully how "values and technologies constantly interact on each other in the dynamic processes of society, because they both are created and transmitted by a common learning process."[6] The learning of values, that is, of preference func-tions, using a term that is familiar to economists, is a little less obvious, perhaps, than the learning of technologies, that is, of production func-tions. Nevertheless, as Boulding points out, all societies devote a notice-able amount of resources to the process of transmitting preference func-tions from one generation to the next, and societies differ enormously in their tolerance of innovation in preference functions.

In the broadest context, Boulding notes the recent emergence of two cultural systems: the superculture of technology and the traditional culture of folk values—national, religious, ethnic, linguistic, and so on. The tensions between them are felt at a great many points and produce many challenges to traditional values. However, up to now at any rate, our ethical values have on the whole arisen out of the traditional cultures rather than out of the superculture.

There is some evidence for the proposition, indeed, that it is those countries which have strong traditional cultures and as a result strong ethical systems that are especially able to create or adapt to the super-culture. Japan is one of the best examples of such a society, and it cer-

[6] Kenneth Boulding, "The Interaction of Values and Technologies" (1966 paper).

tainly is succeeding in developing at a remarkable rate, using technical innovations to a notably greater extent than many other developed nations.

What we seem to face in the future, suggests Boulding, is a very complex set of mutual adjustments, in which an adaptive traditional culture transmitted in the family, the peer group, the church, and the corporation will need to create ethical values and preferences that have to be consistent with the evolving world superculture based on technology and science. This suggests a precarious balance and a great need for widespread self-consciousness about the nature of the problem and the willingness to put resources into solving it. Our acute awareness of the disruptive nature of accelerated change must be made to accommodate the realization that such sustained rates of change may become a new norm.

To my way of thinking, one of the principal resources needed is a willingness to experiment with new concepts, such as the options and consequences of function-oriented institutions. I say "experiment" advisedly, because I believe that we have no dearth of hypotheses, such as my own, and the need is therefore greatest to test, to prove, or to modify them.

Such experiments should ideally be carried out by those persons who have executive decision-making power in the vested-interest groups (government, industry, and labor) concerned with all aspects of satisfying specific functional needs. The advent of computers and associated logic and mathematical techniques provides the possibility for conducting many such experiments through model simulation instead of in real life. The concepts of systems analysis and engineering can be brought to bear—as they are already practiced in the field of telecommunications, for instance. These concepts can provide insights into the interrelationship between parts of a whole which can often lead to unexpected discoveries about objectives, values, and relationships. This opportunity for new discoveries is one of the most fascinating and valuable features of the systems approach, as I see it.

An experiment of the kind I am suggesting was pioneered in recent years by the School Construction Systems Development Project in California. The key features were the following.:

1. Markets were created large enough to spur technological innovation in industry by bringing together a customer consortium of 22 schools in 13 districts.

2. The object of development was the whole system—the school and all its functions—not just a part or component.

3. In the course of development, the system was divided into interconnected subsystems for which performance criteria were developed.

4. A process was set in motion which led to the making of a variety of

alternative inventions meeting these performance criteria, and cost-benefit analyses were made to select the best.

5. The whole building process, including the interaction of all institutions concerned with this process, was taken as the subject of development, and a successful attempt was made to design and rationalize that process.

The working interaction of industry, government, and labor in this project provided a framework in which social and institutional obstacles to change could be anticipated and, at least in part, reduced. This active involvement of all the proponents and opponents to change, in an environment guided by professionals skilled in the systems approach and fully aware of the opportunities offered by advanced technical knowledge, was perhaps the most important operational innovation.

It provided a forum for rational discussion and for mutual enlightenment. It provided recognition that adherence to outmoded wisdoms might even go against the self-interest which had traditionally been the source for upholding the *status quo*. It provided an environment in which commitment to innovation and change became the order of the day and in which all the participants became active agents for change and improvement. In short, as each, in turn, recognized this process of change as of his own making, a favorable climate for innovation was created.

I believe it vitally important that many other experiments of this kind be conducted in response to other functional needs of society and in as many different locations as possible. In this context we should also note that, as McHale has so perceptively stressed, "our current ability to evaluate and determine future goals lags far behind our potential capacity to fulfill any specific goals we may set ourselves. Social accounting, in its widest sense, could provide means for both assessing our directions and framing our goals. The future will be determined not only by what is probable and possible—but by what we, as a society, determine to be necessary, allowable, and ultimately desirable."[7]

I have proposed the creation of a nationwide institution—the Council for American Progress—to stimulate this process of determining goals, of allocating resources, and of fostering change in social mechanisms, and to relate all this to national policy making. Time prevents me from going into details on this occasion. Suffice it to say that the Council's objective would be to illuminate our options for the future, and that it can only function if its members—industry, government, labor, and the professions—will collaborate intimately.

As individual and institutional attitudes change in response to the opportunities of advanced technology for meeting functional needs of

[7] John McHale, "Science, Technology and Change," Social Goals and Indicators for American Society, *Annals of Amer. Acad. of Polit. and Soc. Sci.*, Sept., 1967

society, we will also encounter issues of an even more fundamental kind about business enterprise. The provocative argument has been advanced not long ago by Robert Heilbroner that science and technology, so welcomed by business in the short run for their demonstrated capability of increasing efficiency, imply a social reorganization and reorientation of values so profound that they will in the long run bring about an evolution beyond modern capitalism no less significant than the displacement of feudalism by capitalism.[8] Essentially this is because the social disturbances that technology brings and the steady lessening of the need for human effort that it offers demand new social structures of control and supervision within and over the market place.

But what structures will they be? This is for me the crux of the issue before us. I have no doubt that science and technology, substituting reason for obedience and inquiry for ideology, can move mankind forward in great steps—but whither? The value-free criteria of the super-culture of technology must find their counterbalance in the value-laden beliefs—even myths—of the traditional cultures, lest we might be engulfed by the depersonalizing possibilities of a scientifically controlled world. And again, I therefore plead for open confrontation and revealing experiments to help us determine the optimum balance between the two.

I have tried to indicate why I see in technology less a threat than a challenge and a promise. However, looking at the very long range, I can understand why John von Neumann some ten years ago asked the question: "Can we survive technology?" Adjustments in cultural behavior take a longer time than technological and economic developments. That is why we must begin to experiment with those adjustments now if technology is to serve and not dominate mankind's spirit and aspirations. Change must be our byword and, seemingly, our only constant.

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[8] R. L. Heilbroner, *The Limits of American Capitalism* (1966).

ECONOMIC IMPLICATIONS FOR CONSUMPTION
OF 3 PERCENT GROWTH

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May I start with one general warning: I take it that we are primarily concerned with the broad implications of continued growth. I therefore do not intend to devote time to statistical refinements or the obvious qualifications that should accompany any effort to make comparisons over a long period of time. Instead I propose simply to consider what the shape of our economy would be if the growth rate we achieved from 1865 to 1965 were maintained until 2065.

My best estimate is that over the last century hours worked declined from 67 to 40, or by 40 percent, and the number of years worked from 55 to 45, or 18 percent, while real income per worker increased fivefold, per person sixfold, and per man-hour eightfold.[1] Note that these estimates suggest a growth in real income of considerably less than 3 percent. Even the eightfold increase in real income per man-hour involves only a 2 percent rate of growth. The 3 percent figure I believe stems from, and somewhat underestimates, the increase in total production including the increase in those at work. In view of the wide variations in the rate of population growth in recent years and the uncertainty regarding future growth, it seems to me useful to distinguish between the impact on the economy of a continuance of past rates of growth in per capita real income and consumption, on the one hand, and of growth in population and the labor force, on the other.

Let us start, therefore, by projecting into the future past rates of growth in per capita real income. Assuming a one-week vacation in 1865 and three at present, it appears that in 1865 a man worked 188,000 hours during his lifetime, contrasted with 88,000 in 1965, involving a decline of 53 percent. Exactly the same decline would suggest that in 2065 people would work only 41,500 hours over their lifetime—or, say, 26 hours a week for 46 weeks a year for 35 years. I have no idea whether in fact the decline in hours worked will continue at the same rate as in the past. Much will depend on the use people make of their leisure time. Specifically, the decline may be more rapid in the case of those who find their work boring. But we will be living in a world in which people may have to work less than $3\frac{1}{2}$ 8-hour days a week for no more than half their life expectancy at age 21. Under such circumstances the decline may

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[1] These estimates are derived from the data presented in Tables 28-1 and 28-2 of my *Economic Performance* (Holt, Rinehart, and Winston, 1962).

be less rapid for those who find leisure boring. As I do not know how to balance these contrary tendencies, I propose simply to assume that the rate of decline in hours worked will be the same in the future as in the past, so that past rates of growth can be accepted as appropriate for the future.

The sixfold increase in real income per person compared with the five-fold increase per worker since 1865 reflects increased participation in the labor force, primarily by women. This trend will probably continue, and the percentage of participation will also increase if lower death rates reduce the number of those who now die before reaching retirement age. But these increases may well be more than offset by the greater life expectancy of those who have retired from the labor force. On balance, therefore, it seems best to concentrate on the fivefold increase in real income per worker realized since 1865. In 1965 national income per member of the labor force was around $7,200; five times $7,200 is $36,000. The question then becomes how viable would an economy be which had an average income of $36,000 per worker. To avoid repeating the figure endlessly, let us describe those with $36,000 today as "rich" and those with $36,000 in 2065 as "average." Assuming no change in our present skewed distribution of income, this means that in 2065 one-third of income recipients would have more than $36,000 and two-thirds less.

Obviously a fair number of people, including some even in the academic world, have at present no difficulty in spending $36,000. If one, why not all? Of course one of the things that aids the rich in spending their income is that more of it goes for taxes. Admittedly the overall progressiveness of our tax structure is not great, but I suspect that with present taxes a fivefold expansion of pre-tax income from $7,200 to $36,000 would lead to not more than a fourfold increase in disposable income.

Whether the same relationship will apply in the future—so that by 2065 average disposable income will have increased only fourfold—depends on what happens to government spending. I believe that the non-military share of the national income going to the government will inevitably increase over the next century—primarily because, in substantial contrast to the private economy, most government services appear to be subject to at best constant and more generally diminishing returns. Garbage and sewerage removal, water supply, transportation, even police and fire protection, to say nothing of education, are likely to cost relatively more in the increasingly urban world implied by continued growth. And I shall shortly argue that growth itself will also inevitably raise problems which will require a further expansion of government activity.

Total government spending, on the other hand, depends to a large

extent on what happens to military spending. One can argue that, if we reach 2065, peace must have been maintained and, as a result, military spending must have decreased. Perhaps so. But I shall argue toward the end of this paper that continuing peace is unlikely unless decreases in military spending are accompanied by substantial increases in foreign aid. In fact it would not surprise me if the government's need for funds for both domestic and foreign programs were to prove so massive that the increase in disposable income over the next century turned out to be less than fourfold. Only if peace is possible without foreign aid—if we can exist in splendid isolation—is the increase likely, as I see it, to be much more than fourfold.

Thus I do not think we will be wide of the mark if we take as our basic question: does a rich man with $36,000 today spend his income in ways which would be impossible, or meaningless, or yield him very much less satisfaction if all incomes averaged $36,000? Note that I am not concerned with the problem of invidious comparisons: as I assume no change in income distribution, I propose simply to assume that the $180,000 man in 2065 will still get the same pleasure from feeling superior to the $36,000 man that a $36,000 man today gets from feeling superior to the $7,200 man. Our basic question has two aspects: production and consumption. From the point of view of production it may be quite impossible to provide the average person in 2065 with exactly the same items as the rich received in 1965. Specifically, if 1 percent of beef production is filet mignon and it were exclusively eaten by the rich in 1965, it would obviously be impossible—short of an unlikely reengineering of the steer or an immensely wasteful production of meat—to provide the average consumer with filet mignon in 2065. But the rich in 1865 had venison, buffalo meat, and passenger pigeon eggs on a scale not open to the rich in 1965, so that to the extent that identical items cannot be provided we are faced primarily with the well-known index number problem of measuring equivalents. This we have "solved"—or at least we think we have—or we would not be able to compare 1865 with 1965. I admit to reservations regarding our "solutions"; I am not clear that, despite all the dedicated work of our national income statisticians, we have been able to establish an entirely satisfactory trade-off between a washing machine and a washerwoman, or a TV dinner and a built-in cook. But I believe that the decline in the quantity of personal services available to the rich between 1865 and 1965 was probably greater than the likely future decline in the quantity of such services available to the rich in 1965 and the average person in 2065; already one meets the nicest people any summer Sunday on Martha's Vineyard at the town dump. Bear in mind that only 1 percent of current consumption is spent on domestic service. Certainly many distasteful activities which the rich

today manage to avoid will have to be performed by the average person in 2065, which will significantly change our consumption patterns. But, to repeat my basic point, fundamentally I believe an index number problem is involved, to the solution of which I have nothing particularly new to contribute.

Let me, therefore, turn to the distinction between private and social product. When Pigou developed the concept, I believe he had production primarily in mind. But I want first to apply the distinction to consumption and then later to production. Let me telegraph my punch: I believe that there are significant differences between the private and social benefits of various kinds of additional consumption. Hence, while I am inclined to believe that a world in which incomes average $36,000 would be basically viable, the degree of viability would vary greatly depending on the types of consumption involved. To the extent that this is correct it raises obvious questions regarding the desirability of unrestrained consumer sovereignty and the usefulness of the national income as a measure of welfare, as the national income is primarily the sum of the money value of private rather than social benefits.

Let me illustrate what is involved. While, as just noted, there may be problems on the production side, I see no reason why there should be a divergence between the private and social benefit, which means I see no reason why as a consumer I should be harmed if the average person in 2065 were to have a diet equivalent to the present diet of the rich, for what my neighbor eats does not adversely affect me. But, even if there is no production problem in providing the average man with the cars in general and the Cadillacs in particular now consumed by the rich, the provision of such additional cars would have a severely adverse impact on him as a result of more crowded highways, more accidents, more difficult parking, and more smog. I think the basic distinction is that the consumption of more cars affects the general environment—typically adversely—while the consumption of more food for practical purposes does not. Let us call consumption which does not affect the environment "neutral," that which harms it "adverse," and that which improves it "beneficial."

I suppose I am optimistic regarding the viability of large increases in consumption because most consumption strikes me as neutral while some is surely beneficial. Let me repeat that I am throughout assuming that the production problem has been solved—at least in terms of equivalents —by the very growth of output which we have premised. Thus the issue is not redistribution, for example, of essentially limited medical services from the rich to the average person as a result of health insurance, but rather whether there would be any repercussions on the average consumer in 2065 if there were enough medical services available in that year

to serve the average consumer as well as the rich were served in 1965. In this case the additional consumption, to the extent that it reduced contagious diseases, would clearly fall into the beneficial category. Moreover, even if the appeal of a fashionable restaurant is that it is hard to get into, there is no reason why such a restaurant a century hence should not charge prices which would make it as hard for a $36,000 man to visit as it is today for a $7,200 a year man to eat regularly at the Four Seasons. As a result, it seems to me that average spending on such important items as food, clothing, personal care, medical care, personal business, and even household operation could be increased four- or fivefold and still remain neutral. Yet among them these categories account for two-thirds of consumption expenditures.

Housing, amounting to 13 percent of consumption, is less clear cut. We need to distinguish between floor space and land space. In a typical suburb today a rich man has perhaps three times as much of both as the average person. Providing three times as much floor space should be easy if we are willing to expand upward, but providing three times as much land space has major implications for the transportation system and urban sprawl. Much depends, therefore, on whether we seek to provide the average man in 2065 with the land space today consumed by the rich willing to live on Park Avenue at a land density greater than a Harlem slum or with the space consumed by those rich living in the suburbs at a fraction of the average density.

Transportation, amounting to 12 percent of consumption, overwhelmingly represents expenditures on cars. For anyone who wants to understand the impact of the car on our civilization I recommend a trip by car to the Soviet Union, where as late as 1964 it was possible for a casual tourist to park overnight directly in front of the best hotel in Moscow. Certainly the most obvious difference between our two economies is not such matters as the ownership of the means of production but the simple fact that we have cars and they do not! The only encouraging factor that I can see in this area is that today cars registered are equal to 60 percent of persons eighteen years and over. The sort of increase in incomes we are considering would probably involve at least a doubling in registrations per person and perhaps a threefold increase in road use, and therefore congestion, as jalopies and Volkswagens are upgraded to Cadillacs and mileage driven increases. But even the increase in use is likely to be considerably less than the increase in real income.

Recreation is the final category worth special discussion. Most of the spending involved—for example, purchase of books and magazines—is in my terminology neutral. But much spending is for vacations in which scenery is of the essence, be it the view from a summer home, in a national park, or from a cruising boat. To a major extent the problems just

discussed in regard to housing and transportation stem from the fact that land is limited in quantity, but productive effort can in both cases appreciably mitigate the adverse repercussions on the environment. This is much harder to do in the case of scenery, which is, so to speak, land-intensive. A national park, for example, which is so jammed that one has to line up for a day or so before being allowed in is hardly an ideal example of the virgin wilderness it is supposed to illustrate. Again it has been estimated that if every British family were to want a bit of sea front, the entire sea coast of England, Scotland, and Wales would provide an average per family of 33 front feet. Rising incomes will certainly make solitude and unspoiled scenery very hard to come by.

To sum up thus far: even a fivefold increase in per capita real income and consumption spending over the next century does not seem to me likely to result in serious problems. Admittedly our individualistic tradition from frontier days makes us feel that a man's right to his property includes the right to create an eyesore. It was, for example, only with considerable difficulty that an ordinance was recently passed on Martha's Vineyard denying a man the right to have more than two unlicensed cars—i.e., wrecks—in his front yard. But if we come to be willing to use part of the increase in real income to combat the repercussions on the environment of adverse consumption, it should be possible to keep such repercussions within reasonable bounds. Suppose, for example, we were to agree to use part of the growth of income to cleanse the landscape of dead cars. Once agreement had been reached on the objective, I do not believe it would be difficult to work out effective mechanisms even though it might involve abridging the right of car owners to dump a couple of tons of trash anywhere they wanted. Note, moreover, that the more we accept a public obligation to use the growth of income to preserve the environment, the less will be the growth of disposable income and, therefore, other things equal, the increase in adverse consumption.

Nor am I much less optimistic even when account is taken of the adverse repercussions on the environment as a result of production. Admittedly Pigou distinguished between private and social products before the problem had become particularly acute in the United States. Certainly business has felt as free to dump trash as consumers: unless there is clear scrap value in an item or an alternative use for the land in question, barges are left to rot on the first available mud flat, piers to fall into the sea, and factories to deteriorate into eyesores. But because we are a big country, we could afford to foul large areas of our environment and still have much left that was unspoiled.

Basically, what we need to do is to devise ways of determining the socially desirable cost of production, including the cost of removing the

debris of production. Overall, I think it is fair to say that we have made very little progress in meeting this need. In fact, I am not clear that the problem is widely recognized by economists. Certainly, if I may use what I consider the best single criterion of recognition, it has not yet gotten into Samuelson's text, which tends to treat private costs as if they were all that mattered. In sharp contrast, I submit, to take a specific example, that the construction costs incurred by Con Edison are altogether too important a matter to be left to a private utility. So little has this been generally recognized that it recently took a knock-down, drag-out fight to obtain a court order requiring the Federal Power Commission to give significant consideration to the adverse effects on the environment of the various ways in which power can be generated and transmitted. Again, despite our wealth, we today permit coal mining companies to create immense wastelands in the course of strip mining. But Jamaica, despite her very much lower level of living, has insisted that bauxite mines replace their divots; in fact, because gradients are reduced, the restored land is in many cases more suitable for agriculture than before the mining took place.

Once economists get over considering private costs as sacred, I believe that they have a major contribution to make in this area. For if utility costs are too important to be left to private utilities, they are also too important to be left to conservationists. What we need to determine is the amount to be added to private costs to achieve the socially desirable reduction in the adverse repercussions on the environment of the activity in question—an amount far easier to describe than to determine. For in many cases costs will be hard to measure in dollars and cents. How many million people, for example, is it proper to disturb in order that a handful riding on a supersonic transport may get to their destinations a couple of hours earlier? Unless economists can develop techniques for measuring, in some fashion or other, such almost unmeasurable things, decisions in the future will increasingly be made at best by adversary proceedings in our law courts and at worst by plain power politics.[2]

To sum up once more: I do not believe that the adverse repercussions on the environment resulting from both the increase in consumption and in production involved in even a fivefold increase in real income per capita are likely to be unacceptably large, especially if we devote a significant part of the increase in real income to a reduction of the adverse repercussions in question.

I become substantially less optimistic when consideration is given to probable population growth. For our most recent rate of growth, if main-

[2] Stephen Enke deserves commendation for his pioneering effort to apply cost-benefit analysis to the supersonic transport in the May, 1967, *A. E. R.*

tained for a century, would result in an approximately threefold increase in our numbers, to perhaps 600 millions in 2065. Our average density, however, would even then be appreciably less than present English density. Hence I do not see any basis for arguing that a threefold increase in our numbers would be particularly difficult to achieve.

But if it were to occur, it would immensely intensify the problems raised by both adverse consumption and production. Specifically, if our estimates are correct that a four- or fivefold increase in real income will be likely to result in no more than a doubling of automobile registrations to 150 millions, then we could probably live with the problem without too serious difficulties. But if registrations rose to 450 millions as a result of a threefold increase in population, then even to park the cars bumper to bumper in dead storage would require half the land area of Connecticut. Again, if the average person in 2065 opted to live like our present suburban rich with three times our present average land space, then nine times as much land would be required. In short, as an increase in average real income per capita appears inevitable, it seems to me that whether we face over the next century problems which will be relatively easy to solve or basic changes in the sort of world in which we live depends primarily on our rate of population growth over the period.

But if the growth of our population makes me less optimistic, our relationship to the problems of the rest of the world makes me deeply pessimistic. Mind, I can offer no "scientific" reason why we should be concerned with such problems; I am merely certain that we will be. For we today accept an obligation to do something about the fact that Negro incomes are only half our national average. But the average American Negro lives, statistically at least, as well as the average European and perhaps ten times as well as the average African Negro; hence it seems to me simply inevitable that over the next century—whether for self-preservation or humanitarian reasons—we will have to concern ourselves increasingly with the problems of the 93 percent of humanity that happen to have been born outside the United States.

The minute one accepts any such concern the implications are staggering. Some crude estimates I made two years ago may serve to clarify the magnitudes involved.[3] In 1950 to raise the rest of the world to half our level would have required a threefold increase in world production, provided that all the increase, our own included, went to those below the level in question. If they had to depend on increases in their own production, a ninefold expansion would be necessary for the two-thirds of the world's population living in Africa and Asia. Moreover, were the objective to be to provide the world with half our probable level of

[3] Henry H. Villard, "The Need for Technological Change," in *Technological Innovation and Society* (Columbia Univ. Press, 1966), pp. 158–60.

living in 2000, then a sixteen fold increase in world production would be needed if all the increase went to those below the level in question and a twenty-two fold increase if it did not.

I have allowed myself this expedition into the stratosphere because I suspect what lies behind my assignment today is the question, "Is growth necessary?" I trust my discussion has made clear that the urgency of growth depends on the sort of world we envisage. Even if there were no further growth in our population and we could live isolated from the problems of the rest of the world, I would still be inclined to favor a rate of growth of real income at least as rapid as we achieved over the last century, partly because I have difficulty seeing why the average American should be asked to wait more than a century to live as well as I do today. But I would have to admit that growth under such circumstances would not seem to me desperately urgent. I would also admit that, the more rapid the growth of income, the more rapid would be the growth of consumption and—other things equal—the growth of adverse consumption. But, as we have seen, the repercussions of adverse consumption can be mitigated, or even eliminated, by public spending, and rapid growth of income should make it easier to obtain increases in public spending. I can in fact conceive that slow growth might intensify our difficulties by making us quite unwilling to devote to the public sector the resources that are needed. For I believe that only when disposable income is rising rapidly are we likely to accept what seems to me to be essential increases in the public sector. I offer the thought, therefore, that there may well be a substantial range over which changes in the rate of growth of real income leave the problem of adjusting to growth substantially unchanged. To the extent that this proves to be correct, then I see no reason for not trying to achieve a fairly rapid growth in our per capita income even in the absence of population growth. Certainly I can see little prospect for the success, in the absence of fairly rapid growth, of Galbraith's effort to expand the public sector by simply telling us that we are affluent.

But, whether we like it or not, population growth in the United States is not going to slow down drastically in the near future. Even if our numbers do not triple, they will probably at least double before the increase comes to an end. As I see it, the larger our population, the more urgent does rapid growth in real per capita income become. This is so because an increase in real income resulting from population growth is likely to cause a significantly more rapid increase in adverse consumption than an equivalent increase in real income resulting from higher income per capita. The relative increase reflects primarily the fact that land is fixed, so that, as population increases, we will have to devote increasing amounts to improving and "reclaiming" land. What this means

on a less general level of abstraction is that, if our numbers are going to increase to even 400 millions, we are not going to be able to continue to house the increase in population in suburbs built on land previously in agricultural use miles from the central city but will instead have to undertake massive expenditures on urban renewal. And I hardly need add that immense investment in improving our transportation system will also be needed.

In short, it seems to me that, in view of our probable population growth, continued rapid growth of per capita real income is highly desirable even when we view the matter from our own point of view considered apart from any obligations we may have to the rest of the world. But, to the extent that we as the richest nation the world has ever known do in fact accept a significant obligation to concern ourselves with the problems of the rest of the world, then the growth required becomes simply astronomical in size.

Whether or not I have contributed any clarification, I submit that we have been dealing with issues vital to the future of our economy. It was not ever thus. When I started to study economics in 1930, our discipline consisted entirely of what we would today call microeconomics; in fact only 25 out of the 1,000 pages of Furness, Fairchild, and Buck—the Samuelson of its day—were devoted to what we then called "business cycles." Moreover, with few exceptions, such cycles were considered acts of God caused by sun spots or whatever to be studied and measured but hardly to be eliminated by conscious public policy. As a result, Roosevelt really had no alternative to promising to balance the budget in the 1932 campaign.

The changes since then in our comprehension of what needs to be done regarding economic fluctuations have been spectacular, and macroeconomics today receives at least as much attention as microeconomics. What bothers me is whether micro- and macroeconomics taken together will be of much help in solving the problems we face in the future. Admittedly a major reason I consider macroeconomics not particularly important is because I believe we have solved the problem of maintaining reasonable full employment—though not, of course, of doing so without a steady increase in prices. It is for this reason that I have given no specific consideration to the maintenance of aggregate demand. In short, as I see our world, neither changes in the effectiveness of resource allocation nor in the level of employment are likely to contribute significantly to solving the problems we face.

Mainly our lack of concern with what seem to me vital issues is the result of what is at once the glory and tragedy of our discipline. For our major insight in 1930 was how without conscious planning a free enterprise economy could not merely solve the allocation problem but solve it

in a way highly desirable from the social point of view. But the very beauty of this insight and the conclusion to which it leads, that the economy needs little help from conscious public policy, has tended to blind us to the fact that the problems we face are increasingly incapable of solution by anything even remotely resembling laissez faire.

What are these problems? If I had to pick three, I would pick our rate of growth of real income, our rate of population growth, and our economic relations with the rest of the world. What we need, it seems to me, is once again to move from considering growth of income and population as matters determined by forces beyond human control to matters so essential to the shape of our future that they will have to be decided by conscious public policy. It has been said that economics is what economists talk about. What I am suggesting is that the time has come to change the subject to more important matters than allocation and employment. Take the importance of population. It is still possible for a student to be letter-perfect in the latest edition of Samuelson and remain unaware that any significant change in Indian living levels depends on Indian population growth being brought under control. Certainly no more than a handful of our students understand that it is population growth which is likely to determine whether a century hence we have 150 or 450 million cars. Yet, viewing the matter broadly, we face a situation in which in three hundred years at present rates of worldwide population growth the entire land area of the world will be as densely populated as New York City. Moreover, achieving a cessation of population growth involves not merely making contraceptive information generally available; rather it involves the worldwide acceptance of an average family of perhaps two and a quarter children. That achieving such acceptance will not be easy is suggested by the fact that, even in Japan where both birth control and abortion are readily available under their health insurance program, the net reproduction rate remains well above one.

I do not suppose that these remarks, which suggest that a good deal of what we talk about is no longer particularly important, are going to make me particularly popular. All I have to say in my defense is that, if we do not soon change the subject of our discourse, we will be as hard pressed fifty years hence to explain what we were talking about as I am today to explain why economists made so little sense during the Great Depression.

DISCUSSION

VICTOR R. FUCHS: In my view, one of the most remarkable aspects of this discussion is what has not been rather than what has been said. Not one of our contributors has attempted to seduce us with visions of a sugar-coated land where work is unnecessary and where the basic problem is the disposal of a superfluity of goods. Neither have they attempted to frighten us with the specter of the disappearance of "vital" natural resources without which we will no longer be able to function. This is all to the good. One has only to recall the dire warnings of those who saw a "plundered resource" in every increase in GNP, or the irresponsible pie-in-the-sky predictions of the automation enthusiasts of a few years ago, to realize that today's contributors have emphasized more meaningful problems associated with economic growth.

Michael Michaelis comes closest to slipping from grace when he writes, "We now have, or know how to get, all the technical knowledge needed to satisfy foreseeable human wants." This statement is probably tautological. If not, I suggest that it is incorrect. Ben Seligmen's finger strays unnecessarily close to the panic button, in the other direction, when he bemoans the prospect that "some goods and services will simply price themselves out of existence." Even if there were some service industry that experienced no increase in productivity (I have found very few that do not show some gain), the price of that service would grow no faster than average earnings. Thus the average person could always purchase at least as much of the service as he did before, if he wanted to. Given that other goods and services would become relatively cheaper, he might choose to substitute them for the more expensive service, but this can hardly be regarded as a loss of welfare or a cause for alarm. Unless productivity advances at the same rate in every industry, there will always be some commodities becoming relatively cheap and some becoming relatively expensive.

Henry Villard, long an enthusiastic advocate of growth, seems to have bent over backward to find some problem to discuss. He picks on an increase in the number of automobiles as a good example of "adverse" consumption, but is the evidence so clear cut even in this case? I can think of at least two beneficial effects of an increase in automobile consumption. First, it will make possible the economic production of a greater variety of cars—hopefully including some with extra leg room—and, second, it will make economically feasible the construction of many roads, bridges, and tunnels that we would like to but do not now have. Those who think they see only "chaos in transportation" should note that thanks to new roads and tunnels it now takes less time to move through or between major cities than it did fifteen years ago, despite the large increase in motor traffic.

If economic growth poses no insuperable problems on the side of either consumption or production, does that mean that all we need do is lean back and enjoy it? I think not. I think the experience of the past century

makes it abundantly clear that continued economic growth is likely to pose major challenges to our institutions and social structure. These challenges, it seems to me, will not be technological or economic, but will be political, social, and, above all, moral.

One institution that is not likely to survive another hundred years of economic growth is the sovereign nation state. A supranational body or several such bodies will be needed to control the weapons of mass destruction, to redistribute goods on a far greater scale than we have seen to date, to provide central banking functions, and to deal with the problems and potentials associated with the exploitation of the oceans and of space.

A second institution that may undergo radical change is the family. The role of women is already being transformed as a result of improvements in contraceptive methods and the growth of a service economy. Most service occupations offer no premium for physical strength. Therefore, apart from the differential in labor force attachment (and this differential seems destined to become much smaller), women are likely to approach economic equality with men. This development would have profound effects on marriage and family structure.

Religion is another area that is likely to see major change. Some people expect the increase in man's ability to control his environment to result in the elimination of religion as a major factor in society. I do not share this position, provided one takes a broad view of the religious function. It seems to me that the advances that will occur in our ability to control, modify, create, and prolong life are likely to raise grave moral questions—questions which cannot be answered by science or technology. These questions will create a need for specialized institutions, staffed by men and women who have the training and the temperment to help society resolve moral dilemmas.

It would not be difficult to extend these speculations, but I would like to turn instead to one implication of economic growth that is as certain as anything can be. This is the prospect of the growing relative scarcity of time. The theory of the scarcity of time and some of its implications was first given rigorous treatment by Gary Becker and Jacob Mincer.[1] The subject has recently been developed in a highly enlightening and entertaining way by Professor Staffan Linder, of Sweden, in a soon to be published book, *The Theory of the Haunted Leisure Class*. The basic notion is disarmingly simple. When productivity is low, time is relatively cheap. When productivity is high, time becomes relatively expensive. With continued economic growth the problem of allocating time will increase; the implications that flow from this fact are numerous and important.

One of the many interesting points made by Linder is that each successive increase in output adds less to pleasure than the previous one, not for the usual reason of diminishing marginal utility, but because it must be combined with a relatively fixed amount of time. In other words, we are faced

[1] Jacob Mincer, "Market Prices, Opportunity Costs, and Income Effects," in *Measurement in Economics, Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld* (Stanford Univ. Press, 1963); Gary S. Becker, "A Theory of the Allocation of Time," *Econ. J.*, Sept., 1965.

with a new version of diminishing returns. One consequence is that we now have an increasing preoccupation with economic growth, even though our affluence might have been expected to lead us to stress noneconomic goals.

To be sure, a preoccupation with material advancement has its advantages too. The hope of financial gain seems benign compared to most of the incentives that have moved men to effort and risk-taking. One danger that we face is that the diminishing returns experienced from affluence may lead to a substitution of goals, such as power over fellow men, or may encourage a search for other sources of pleasure, such as violence or drugs.

Perhaps the most serious problem posed by economic growth is summed up in the phrase, "abundance for what." Another century of material progress will sorely try the optimistic notion that each individual has great potential for creativity and salvation. It will, in my judgment, force us to return to such timeless questions as the purpose of life and the meaning of "good" and "evil." The answers that we give and not the size of our GNP will determine whether we will have a truly great society.

JOSEPH L. FISHER: This paper by Michaelis is thoughtful and stimulating. For its approach it draws heavily upon Veblen and various scientist-engineers who have addressed themselves to technological aspects of economic and social problems, as well as upon the institutionalists who have been more strictly in the economics profession. In the paper Michaelis argues that "technological innovation—that is, the application of knowledge—must . . . be the focal point of our discussion, and the question before the house is whether and how we can sustain—or increase—the rate of such application." He sees a great plenty of scientific discovery on which to draw, but he fears that social conservatism and the well-known cultural lag, especially within business and industry itself, will hamstring the application of knowledge to human betterment by way of industry. At times he seems to be calling for social revolution, perhaps a takeover by the technocrats—those who understand and operate the "technostructure." At other times he seems to be calling for a preservation of social customs and even myths as the only means for stabilizing, humanizing, and coping with the otherwise uncontrolled progress of technology.

I have some doubts about several of Michaelis' points: for example, that there is on hand enough technical knowledge to permit all human wants to be satisfied, or that the technocrats are really going to get away with wielding the ultimate power in the society of the future. But I want to get on to other matters.

The most constructive part of the paper is the call for the systems analysis approach, oriented to large social-economic functions. Michaelis' example of the washing and cleaning of clothes is down-to-earth, but it does not catch the spirit of the thing as well as the lunar landing, the handling of urban transportation, or the abatement of water and air pollution. In the matter of water pollution, for example, recent experience in the Delaware River valley and elsewhere exhibits clearly the advantages of the systems approach in which the problem and the possible lines of solution are sur-

veyed, alternative objectives are selected and stated in concrete terms
(e.g., parts per million of dissolved oxygen, coliform count, turbidity, etc.),
the least-cost method of obtaining each of the alternative sets of objectives
is determined after appropriate analytical models are constructed and
solved by means of computers, and further steps are taken in the by now
familiar sequence of activities. One of the interesting features of the Dela-
ware River case is the attempt to involve interested parties, including the
general citizenry, in selecting the objectives, approving the solutions, and
understanding the whole process.

I would argue that the systems approach in this and other cases should
be extended to embrace the political, economic, and social institutions and
processes which will have to be involved in making the system operational
in the fullest sense of that term. There are minimum conditions for accep-
tance of a water quality management system on which various interest
groups will have the power to insist. These also should be studied and from
the beginning brought within the ambit of the system, from the setting of
objectives to the selection of the most effective activities for doing the job.

I have no doubt that Michaelis would agree quickly to this extension of
the more conventional analytical system to include institutional elements;
he says as much at several points in the paper. For example, he speaks of
"the learning of values, that is, of preference functions" and "the learning of
technologies, that is, of production functions." And he notes with approval
the way in which Japan, a country with a strong traditional culture and
ethical system, seems to have been able to create or adapt the "supercul-
ture of technology." Perhaps systems analysis extended to include the
social-institutional elements can be the answer in this country to the chal-
lenge of speeding up technological innovation without allowing it to run
wild. We in the United States are now in the throes of trying to deal with a
variety of problems—such as urban transportation, new towns whether out
in the country or in town, air quality, provision of education, and even pub-
lic welfare—through a systems approach broadened to include social and
political considerations as integral parts of the whole. Only in this manner
can the full range of what are now called "side effects," on the benefit and
the cost side, as well as the full potential of technology be brought into the
policy-planning-decision-action framework.

At a fairly early point in his paper, after asserting that the shortage will
be in technological innovation rather than scientific discovery and know-
ledge, Michaelis recognizes the inherent possibilities of resource limitations,
both physical resources and limitation of aggregate demand, as a matter
deserving some attention, and he invites me to comment on the matter.

In response, I should say that from any given point in time, there is
a tendency to look ahead in terms of a set of projections characterized on the
one hand by the easily visible and rapid increase in population that will place
large demands on basic resources and raw materials if levels of living all over
the world are to increase in line with hopes and expectations, and on the
other hand by limited supplies of food products, fresh water, forest products,
mineral and energy commodities, and even space as seen in terms of the

existing or near-future technology. Such an approach, of course, stacks the game against rising levels of living and in favor of the view that raw materials will limit economic growth. But the comprehensive and systematic examination of the resource and raw material situation and outlook for the United States as compiled in Resources for the Future does not confirm this picture, at least through the end of the twentieth century.

Resource adequacy in the United States to meet the larger demands of the year 2000 would seem to be assured, provided several critical conditions are met: the continued expansion of scientific knowledge and its application in industry and agriculture, maintenance of a reasonably efficient world trading and investing system, and continued improvements in resource policies, management, and conservation. Deterioration of the quality of resources and the environment is likely to remain a more serious problem in this country than any lack of quantity of raw materials. At this point I have to register approval for much that Henry Villard had to say on environmental quality.

Looking to the world at large and especially the less developed regions the outlook is mixed and far less optimistic. Assuring improved diets for the two-thirds of the world's population which is now hungry, with due regard to adequate proteins and vitamins, will tax the ingenuity, both technical and political, of national leaders everywhere. The outlook for energy resources is much more favorable; over recent years per capita consumption of energy commodities has risen in all countries and more rapidly in the poor countries than in the rich ones. But for the world as a whole, as for the United States, the critical considerations on which resource adequacy will depend are scientific advance and technological innovation, including the improvements in education which make them possible, better management, improved policies, and a greater awareness of the handling of the resource base of land, water, minerals, and air so as to assure continued progress.

So I end in good agreement with Michaelis as I consider his ideas from the standpoint of natural resources. The things to do are to keep a full head of steam behind technological innovation and to aim particularly at those regions and social groups most in need, and simultaneously to undertake social-political-management experiments which will match in scope and daring the possibilities of technology.

BEN B. SELIGMAN: It is refreshing to have before us the bold speculations that Professor Villard has offered. Breathing the refined air of the stratosphere can be invigorating, particularly when impecunious academicians are tantalized with the prospect of a $36,000 annual income. But, alas, we shan't survive that long. It is all for our great grandchildren to enjoy. Professor Villard's speculations do underscore the poignancy of the Keynesian quip about long runs.

Be that as it may, one must nevertheless accompany Professor Villard on his journey into the time-space continuum even when one is limited to the precise figure of 1,200 words. Space trips, however, generate problems, as we have learned, and here too there seem to be several troublesome ques-

tions that require amplifying. While I share the pessimism expressed on matters concerning our relations to the rest of the world and am just as perturbed as Professor Villard by the prospect that continued population growth will turn vast areas of the land into parking lots, I cannot partake fully, much as I should like, of the belief that growth of the sort he has described will be absorbed by society without inducing some serious side effects.

I think it would be accepted by most economists that the last hundred years has revealed a striking trend in the movement from primary to secondary to tertiary industries. And it would be fair to presume that these trends will continue in the calculable future. As a consequence, one of the problems of that future will be a palpable upward drift in costs, especially in the tertiary sector. The latter encompasses activity that is by and large labor intensive, a situation about which it seems little can be done. Not even economics professors relish the prospect of an automated haircut, especially if the conversation on weather were to be packaged like TV commercials; and while the productivity of some services can be improved by technological advance—supermarketing is a case in point—many seem to be impervious to change. The outcome, I think, will occasion alterations in the overall pattern of production that do not enter into Professor Villard's argument. If there are differential rates of growth in productivity, while income, and of course, wages, rise as steadily and uniformly throughout the economy as Professor Villard posits, then costs in the less technologically advanced sectors must necessarily rise; in fact, they may rise so rapidly relative to the income and output of these sectors that some goods and services will simply price themselves out of existence. It is perhaps just this sort of relationship that accounts for the decline in certain hospital occupations and the disappearance of such jobs as night watchmen, elevator operators, and domestic help.

Indeed, if the implications of such trends were to be spelled out in detail, then the greatest likelihood is a continued decline in costs in secondary sector pursuits together with the absorption of a smaller proportion of the work force in such pursuits—all coupled to an impending disappearance of certain services. All this makes steady growth, even at a 3 percent level—a process that cannot but generate problems of serious import. The overall structure of production and work force participation will have been markedly altered under such conditions. Those of us who reside in smaller communities may perhaps note these trends more clearly. Has anyone tried to find a craftsman lately?

I would suggest that Professor Villard's growth in income requires a tremendous growth in productivity. While such productivity growth may come about in the secondary sector, the latter is becoming a relatively smaller proportion of the total economy. Meanwhile, as the tertiary sector expands, we will find manpower and resources redirected toward precisely that part of the economic system in which productivity expansion is problematic. Moreover, it is possible to demonstrate that costs per unit of output

in the tertiary sector will rise more rapidly relative to cost movements in the secondary sector.

It is true that changes taking place in the secondary sector, particularly those of a technological character, may raise incomes—but only for that part of the work force that continues its attachment to secondary pursuits. But for large parts of the work force such attachments will have been severed. I suggest that a fair measure of displacement into alternative occupations will occur where the trade-off will have resulted in reduced marginal productivity and consequently reduced real income. It is indeed conceivable that technical change will provide a high average per capita output—a condition that forms the basis of Professor Villard's discussion. Yet changes in production patterns may be such as to enforce a low marginal output.

To be sure, technical progress and net capital accumulation will tend to increase output per capita, but only in the secondary sector. And we have suggested that such average output in the tertiary sector may indeed lag. Now, according to standard analysis it is the marginal output that is relevant to such problems as functional income distribution, and with a lower marginal product, it is conceivable that wage income will shrink proportionately, as the larger part of output will flow to other factors in the economy rather than wages. These are the sorts of considerations that seem to me to pose critical issues in the evaluation of growth. For they suggest something less than the complete viability that Professor Villard speaks of.

Professor Villard also seems to imply that consumption patterns will continue to generate what he calls neutral effects. Yet the diminishing urgency of satisfying certain human needs in a high-income economy, while themselves neutral, may generate the sort of spillover that serves to reduce neutrality. For example, he has classified medical care as essentially neutral. But when such services are affected by the sort of productivity patterns and cost elements to which I have referred, it is conceivable that a $36,000 a year income will still be insufficient to purchase that service. One may respond that it depends on the sort of value system the society evolves: no doubt whatever astronomical level education costs may reach parents will continue to pay the bursar's bill because Johnny must have that college degree. But such situations may occasion general insistence that alternative ways of offering the service be developed, such as a shift to the public sector. Should this take place, consumption can no longer be deemed neutral.

If I stress the problems that may ensue as stemming in large part from the production side, that is because I would tend to minimize the power of consumer demand and consumer sovereignty. I suspect that consumption will react to rather than condition the shape of production in both the secondary and tertiary sectors. Nor will consumer demand per se have much immediate impact on the public sector, unless there is a conscious political effort to enforce the impact. Whether growth will be 2 percent or 3 percent compounded annually over the next century will hardly alter the complexion of the issues we shall have to face in the city and in the countryside. The need for a Lake Michigan with live water will not be met by the imperson-

alities of steady growth. Specific problems will require specific measures unavailable in the market. I should have liked a more explicit review by Professor Villard of such nonmarket questions, for in the coming age of social economics, they will be central rather than peripheral to human concerns.

In particular, I must agree with Professor Villard when he urges that private costs ought not be so sacrosanct as they have been. But since such costs involve externalities, they should be discussed, not so much in terms of their inherent virtues, but rather in terms of their external vices. As Professor Baumol once suggested, the cost of externalities appears to increase geometrically with the increase in population. I suspect there is something of a clash between Professor Villard's justifiable sense of unease regarding private externalities and their consequences, and his conclusion that increased per capita income will occasion no serious problems. Attention to the sphere of production tells us that there will be problems aplenty.

I am not at all certain that growth is the *sine qua non* for dealing with the externalities of such costs as Professor Villard appears to assume. His contention that an expanding disposable income is a precondition for treating deficiencies in the public sector seems to me to be inacceptable. The fact that we are now so affluent while conducting a shooting war suggests a strong measure of validity to the Galbraithian thesis. (I shall not be so cynical as to say that war is the health of the nation.) This issue quite patently involves the political decision-making process in our society to which even we as economists need to pay attention. To rely solely on a 3 percent equation seems to me far too trusting of some unseen hand that will overturn the golden calf of private cost. Indeed, what assurance do we have that growth will by itself provide a more socially desirable allocation of resources? No, I would insist that resources are and will be available and sufficient and that it will take conscious political will on our part to initiate a meaningful beginning in dealing with the horrors of private externalities.

ECONOMICS AND NONECONOMICS OF POVERTY

A CLINICAL ECONOMIST IN RURAL POVERTY

By WILLIAM H. COOPER
Bucknell University

About two years ago, life tossed me into a role that I think of as that of a clinical economist. While directing a six-weeks training program for rural poverty workers, I agreed to place forty trainees in homes of low-income families for a period of three weeks where they would eat the same poverty fare, sleep under the same roof, and observe the life-style of these less affluent citizens.

In a general way these families are my neighbors, as I live in a Pennsylvania county that is small both in population and area. The largest town has a population of about 6,000. Much of the area is mountainous—with a scattering of small communities whose populations are less than 500. With the assistance of the county welfare director, I traveled roads that I had never discovered through mountain gaps and ridges to meet our county poor. Working with an imaginative and willing staff, we began to ask low-income families whether they would be willing to expose their personal lives to complete strangers for three weeks in return for a small room and board payment.

My first-hand (almost bedside, in the true clinical manner) observations of local rural poverty, that began with this experience and continued in similar ways, have led me to think of this part of my activities as being a clinical economist. If there are clinical psychologists, why not clinical economists? My observations are not likely to produce any discipline revising conclusions, but, within the limitations of a small sample, the work seems enlightening to me. The idea of a clinical economist is offered neither as a substitute nor criticism of other economic methods but rather as an additional way to further economic understanding.

If others are interested in extending a clinical economics method, we might find it useful in examining some of our traditionally accepted (though sometimes questioned) assumptions. As an example, for years I have been teaching economics students that men, as individuals, logically pursue self-interest to maximize either their real or psychic in-incomes, and, although I have warned the students that sometimes through lack of information these logical individuals don't always succeed in maximizing satisfactions, their more or less continuous efforts are in this direction. Then I move on to the next lesson which is sup-

ported by this assumption. It seems to me that this is the kind of assumption we could examine as clinical economists.

I must admit, also, that my experiences have caused me to question the defined limits of economics. In fact, economics has always been difficult to define, but it is even more difficult to determine whether some parts of actual situations are really within the boundaries of economics. At what boundary do we leave economics and move into sociology, psychology, or philosophy? The closer I am to a real situation, the harder it becomes to define and sort out the observations so that they fit the disciplines.

In addition, a clinical examination of economic problems soon brings one to wonder about ways being suggested for the resolution of certain problems. Frequently, attacks on the problems seem to be so unrelated to the real situations that they approach a kind of autistic thinking that makes me wonder whether the fellows working on programs to meet these problems have ever stepped out of their offices.

I can't begin to relate all of my observations as a clinical economist, but I would like to describe several scenes located within a few miles of my office.

When we first visited the Carlson family and talked to Mrs. Carlson about placing a trainee in their home, she told us that we would have to see her husband, who wasn't there, as he made all of the decisions. We returned and entered their kitchen-dining-living room and found George Carlson leaning over the sink. He turned around, his hands covered with blood, and said, "It's either me or the ground hogs. They try to steal my garden food from me, so I eat them. I'm skinning one right now."

The rural poverty trainee, who lived there for three weeks, told us that the average meal was stewed tomatos, potatoes, and water. Mr. Carlson maintained a dominant, shouting, threatening relationship with his nine children and his wife. Although they have lived in a substandard dilapidated house on the side of a mountain for four years, they have not become acquainted with their neighbors. The minimal existing social relations are all within the immediate family plus his parents. The children attend school, but they have never purchased new clothes for them, and they are all suffering from malnutrition. Mr. Carlson seems to be so completely socially awkward that he is unemployable. They have moved away from employment opportunities to live on almost rent free mountain land, and lack of public transportation, as there is none within our county, keeps them isolated. They have purchased two used and worn-out cars on credit, but, as car repairs are not available on credit, both cars remain out of service.

When you enter the house occupied by the Wiggins family, you

become aware that the rooms are not identifiable in ordinary recogniz-
able classifications. Four-letter words written in pencil, crayon, and
lipstick cover the plaster that surrounds gaping holes in what might
have been the living room. Six early outmoded, broken down TV sets
clutter the floor. Fragments of numerous layers of linoleum-like floor
covering don't really cover anything. Mrs. Wiggins, about thirty-five,
talks incoherently through her few remaining teeth while six children
somehow avoid tearing their flesh as they bounce upon the exposed
springs and bare wooden frames of once upholstered furniture. Mr.
Wiggins is not present because the family has discovered that welfare
payments are larger if he and his wife each receive checks as a separated
family. Mr. Wiggins, we discovered, returns late at night and dis-
appears before dawn to avoid a confrontation on this subject with the
case worker, whom they both fear. Mr. Wiggins has held unskilled
jobs for short periods.

A third family lives in a small community. The husband has been in
and out of a state mental hospital. The disheartened wife and children
do not maintain minimum standards of cleanliness. Clothes are neither
washed nor ironed; the unattended dog is permitted to deposit filth in
any corner within the apartment; one faucet provides the total supply
of running water and the family uses toilet facilities in gas stations,
public buildings, and homes of neighbors.

These might seem to be abnormal cases, but a clinical economist will
soon discover many of the families with less than $3,000 income, which
constitute about one-fourth of our county, have problems that seem
unusual.

Some of the families who fall within the less than $4,000 classification,
who make up about one-third of our county, have some interesting and
different attitudes about their economic behavior. There is a community
of 160 people at the foot of a mountain on the road to nowhere, and I
have tried to discover why the citizens continue to remain there. After
becoming acquainted, they were friendly and talked freely when I asked
them why they continued to live in this community when better paying
jobs are available in cities within the state. While the answers varied, a
common theme was expressed by the local car mechanic who said,
"I wouldn't leave here to live in the city. Who would get me out of
trouble? Here everybody knows me and would help me out. I know all of
them, too, and I would do the same for them."

An older citizen said, "You know I don't have much money, but I do
own a farm over by the creek. I decided to see what would happen to it
if I let it alone. I don't want anyone to either cut or cultivate it. The
small animals sure love it."

Another told me, "Of course I could earn more in the city, but then

I'd be living in a place that I don't want to be and trying to save my money to take a two-week vacation back in the country where I like to be."

Any generalizations drawn from these and similar limited observations are certainly questionable, but I do feel that there is a useful function for a clinical economist.

Meeting, seeing, and listening to these low-income people suggests that they frequently make decisions affecting their economic behavior on the basis of a nonlogical sentimental response in contrast to any logical attempt to maximize their satisfactions.

Of course it might be argued that these strange people are not the typical citizens described in our elementary economic principles. This may be true, but they do represent as much as one-third of our local population.

These observations might also indicate that many of this group seem to have emancipated themselves as much as possible from a market economy both as factors of production and as consumers. They almost seem as though they couldn't care less about market rewards and penalties in regard to their behavior. They will work at a job that they can get by on, but the job is of less significance to them than fishing, hunting, or doing as they please, and they do not extend themselves in the direction of increasing their income. This is not a matter of being on or off welfare, as most of them do not qualify for public assistance. Are these people another group of drop-outs from an industrial society?

Within the small communities it is difficult to determine whether decisions are made by individuals or by a larger form of social organization. When a fellow says, "I've been here all my life, and I belong here. I would just die if I had to leave my neighbors in this town," one begins to wonder about whether he has retained his ability to arrive at any significant individual decisions regarding his economic behavior.

This may be difficult for those who live in impersonal cities to realize. I have noticed that some newcomers to our faculty are shocked when they begin to recognize that some of our local community leaders, who provide strong lip service in support of individual thinking and behaving, are so completely tied to the personal relationships in a small community that they seldom express independent individual views. These leaders become extremely upset when a member of the faculty defends a logical, independent, and individual idea.

The poorest of the low-income groups in rural poverty in our county are often loners in regard to the location of their homes and their outlook. As has been indicated above, some are incredibly socially awkward. This awkwardness is reinforced when they are forced to move to the mountains. Our highways are planned to connect the farms

located on the good land in the valleys to the markets. The poor on back mountain roads are out of sight and socially and politically unrelated. From the poverty workers viewpoint, they are difficult to visit, manage, and organize and receive less, if any, attention. Is their social awkwardness a problem for economists? Can we begin to meet their needs without taking it into account? Would some kind of guaranteed income bring them out of the hills? If we could bring them out of the mountains, what measures might we recommend to improve their social as well as their technical skills so that they could become usefully employed? What should we be doing about their children, who even with public education seem predictably doomed? A clinical economist will begin to conceptualize these problems, and he may arrive at some better understanding about what policies and programs could be effective. These observations seem to indicate that mechanistic answers to the great diversity of problems will not be wholly effective.

I don't feel quite comfortable about turning all of the problems of the rural mountain poor over to the sociologists or psychologists who might be equally concerned but who may not see as clearly as an economist the problems in their relation to a total economy. We are a social science concerned about relations among men, and we have a responsibility to become deeply involved in these problems. There is a role for a clinical economist who may believe that a first-hand observation process is essential in preparation for the process of conceptualization and rationalization of collected data.

Then, too, there may be a useful function for the economist who feels that he must not only read about economics but must somehow live with economics. Much of what I have observed is available in books about poverty by writers on general subjects, but there are aspects of poverty situations that might be overlooked by the general observer that would become apparent if economists worked clinically in actual situations.

The forty poverty trainees who lived with the low-income families were especially interested in this part of their training; they claimed that this is the kind of relevance in education that they seek but seldom find in our colleges. I am thoroughly convinced that they are offering a useful idea for educating economists. I would like to place all of our economics students in poverty homes, on production lines, in urban slums, in migrant camps, in government offices, in financial institutions, and in large and small business firms for short periods of time during their educational experience while they have an opportunity to contemplate the meaning of their observations, and many students would welcome this kind of first-hand educational experience.

My small sample has caused me to wonder about what basic assump-

tions one might make concerning the rural poor, and I would like to see more clinical economic observations to determine what might be validly assumed in planning programs to meet their needs. Our local, rural, low-income groups seem to have some of the qualities that I have already indicated. The poorest are frightened about their neighbors, public welfare workers, and the world in general. Along with this fear, they appear to be socially unrelated to the world and income opportunities.

Families with slightly more income are sentimentally tied to small communities. Neither group is logically attempting to improve their individual welfare; they are not interested in becoming enthusiastic members of an industrial society. If these assumptions are true, then welfare programs aimed at job training, guaranteed employment, increased income, or mobility may completely miss the mark because they are based upon invalid assumptions.

While observing the poor, I have become interested in the role of the welfare worker. The public welfare worker is in an unenviable and unattractive situation in a rural county. He is not only feared and disliked by the poorest of the poor because he is unable to really meet their needs due to inadequate programs, but he is scorned by his fellow citizens who see him as one who gives away their tax payments. The income, role, and status of welfare workers will have to be improved considerably if we expect to attract individuals into this profession with the ability to satisfactorily meet the needs of low-income groups.

The role of a clinical economist in rural poverty is not without hazards. The dangers are not as much physical as mental. Wandering around the mountains can send an economist on almost as wild a trip as "acid." One may begin to speculate about what might happen in one of the smaller communities if an experiment could be created to provide every family with a minimum income of $10,000 for the next twenty-five years. Would they accept the offer? How would their behavior change? Would they all stop working? Would some send their children to college? Would they save or spend? Would their birthrate change? Would they build new homes?

You can see how wild one's ideas can become? But then I would need as much as $10 million dollars to carry out this program, and I'm not certain that I should try to set up a controlled experiment on the economic behavior of human animals. How would they feel about it in 1992 when the guaranteed income terminated?

The trip between rural poverty homes may expand the mind of a clinical economist in some wild speculations about what one would like to see these people become? Do I want them to adopt middle-class values? How much better off would they be as more ardent producers

and consumers? When a man in the less than $4,000 classification says, "Yes, my children may have the advantage of a better education and more opportunities in the city, but they might join a gang of muggers," should I work on programs and policies to encourage him to get out of the rural community? Or would my objective be to help them regain some faith in their own dignity? Or, if I am not anxious to have them adopt middle-class attitudes about their living conditions, is it their aesthetic sensitivity that I would like to improve?

As you can see there is the danger of the social scientist becoming mixed up in value judgments, and some of my colleagues tell me that scientific economists are supposed to leave these matters to the department of philosophy and religion or to economists who write popular books or work for the government.

I am not satisfied completely with the idea of a role for a clinical economist, and when I see the wide disparity between the inadequate or inappropriate programs reluctantly approved by legislators far removed from rural poverty and the actual conditions, I begin to consider the need for an existential economist, and I begin to wonder whether some of the most useful contributions in the history of economics might have been made by men who could be considered existential economists. But that's another paper.

CASUALTY RATES AND THE WAR ON POVERTY

By ROBBIN R. HOUGH
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Historically, the development of large-scale statistical programs has proceeded in a conservative fashion, and rightly so. Even without Professor Morgenstern's exquisite caveats, social scientists should continue to address the inauguration of new large-scale statistical ventures with considerable skepticism. With respect to large-scale social action programs, however, diminishing returns to such counsel may be setting in and a bolder variety of counsel may be not only helpful but essential.

The paper which follows will first briefly characterize the data collection processes which currently accompany large-scale social action programs. Second, the paper will discuss several ways in which such programs have failed to induce the optimal dialogue required for the solution of the problems to which the programs were addressed. Third, it will attempt to sketch the difficulties which may be encountered in the development of one alternative form of statistical program. Finally, it will examine briefly a range of the benefits which might be expected to flow from an alternative statistical program.

At present, three data collection efforts directly accompany the development and administration or major social action programs in the United States. These efforts may be most clearly distinguished by the purpose for which they are initiated. These programs (1) demonstrate that a problem exists in a particular locale on a scale large enough to warrant attention; or (2) demonstrate to the appropriate auditors that the funds allocated were spent legally; or (3) estimate the impact which a completed program had while it was operating.

While there is a mild tendency for these three activities to overlap, the order of the staging follows roughly the order of presentation above. As a result, the basic data from which research contributions are likely to come are gathered from general sources during phase 1 and, on an *ad hoc* basis, in stage 3. Recognizing fully the contribution of researchers in administrative and advisory capacities, it may be taken as given that the ongoing processes of such action programs yield little, if any, substantive public data by which to either evaluate the interaction between institutions generated by the programs or gauge the progress of the program toward its specified goals. As a further result, an important variety of potential dialogue between public adminis-

trators and academics is severely restricted, if not cut off entirely from short-duration developments in the action programs.

Without discussing the underlying details of the research program involved, I would like to relate four short research vignettes which I believe display at once the potential value of the dialogue and the inadequacy of our data systems.

Vignette one concerns the relationship of the educational system to the war on poverty. In order to provide background data on a large number of low-income families, a random sample of school children in a low-income area was selected. A questionnaire was then administered to the teachers of these children. The questionnaire essentially sought to obtain from the teachers' point of view a picture of the individual households as they might affect the educational outcomes of the grade-school children involved. The first set of questions asked related directly to the family; the second set related to the children. By analytic interaction detection techniques it was determined that the teachers viewed the children's probability of success (as measured on a five-point scale from "probably will not succeed" to "probably will succeed") as strongly related to their attitude toward adults. The data were then examined in order to determine to what extent differences in the children's probabilities of success were related to differences in the information which the teachers were able to furnish by way of the survey instrument. The results speak for themselves. The teachers' possession of information about the family was totally unrelated to the probability of success as viewed by the teacher. On the other hand, in virtually every case where the teachers predicted a negative outcome for the students involved, they were unable to answer the set of questions about the children themselves. Based on this data, a simple Markov process model can be constructed which depicts quite accurately the school dropout rates.

Vignette two grew out of the geographic plotting of active tuberculosis cases in a midwestern city. It was found that a single small area about the size of a census tract had an incidence rate twenty times the national average. The researchers involved were not physicists and thus not able to reach particularly valid or significant conclusions regarding the fact that they lived a mile and a half downwind from a large industrial smokestack.

Vignette three concerned a training program designed for the unemployed. Though initiated primarily on the basis of high unemployment rates in a particular low-income Negro area, at its completion not a single male Negro from that area had been trained. A large number of Negro females from the same area did successfully complete the program.

The final vignette concerned a decision. The decision was relatively simple. Should a neighborhood youth corps project be sought, since there were easily enough eligible youths in the area covered to justify such a program? Should it make any difference that the youths were rather evenly distributed over a 900-square-mile area?

Each of these vignettes involves the interpretation of the results of research and could grow out of any local poverty program in the U.S. Each also involves powerful institutions other than the social action agency. Without a period of harmonious interaction between public administrators and academics, these vignettes would not have been uncovered. As the distances between the academics and the public administrators grow, the probability that these vignettes will be uncovered or that appropriate public policy will be formulated declines quite rapidly. How can an optimal level of communication on matters of substance be achieved between these two groups?

Suppose, in contrast, that administrative and research purposes are to be met by the same data system. It would be necessary that the data system be fully specified in form early in the launching of the administrative program and the continuing operation of the program would provide the contents. From a theoretical point of view, alterations and extensions of Tinbergen's general specifications for planning models would allow the concise form of the data system to be specified. Briefly, it may be argued that the following four a priori specifications must be made: those institutions which the administrative program may be expected to aid, those institutions from which it may expect to receive help, and those from which it may expect conflict; the goal or goals attributed to each institution; the instrument variables at the disposal of those institutions; and the intervening variables and parameters which may be expected to condition the relationships between instrument variables and goals.

Moving from macro policy models to models relevant to campaigns in the war on poverty involves, of course, more dramatic matters. The Tinbergen type of model is based on thousands of man-years of research and extensive testing. The job of specifying such parametric policy models for subsequent use in data collection without the benefit of extensive testing is a hazardous occupation. The potential benefits of such adventures must clearly outweigh the costs. Short reflection will reveal some of the sources of the numerous hazards.

The formal institutions which seek roles in social action programs are many and varied. A list of such institutions is not coterminous with the list with which economists have historically dealt. Educational, religious, political, and philanthropic organizations whose goals are not obviously definable in conventional terms would have to be included.

In a similar vein, economists have not dealt with the full range of instrument variables available to the institutions with which they are most familiar. The theory of consumer behavior, for example, is concerned primarily with choices among goods and collections of goods under varying assumptions regarding substitutability, certainty, uncertainty, risk, etc. The effect of restricting our analysis has been to de-emphasize the broad range of actions available to the consumer. It can be observed that the "option to buy" is a choice which may interact in significant ways with the consumer's other instrument variables, a brief list of which variables might include measures on mobility, search, philanthropy, rest, and ornamentation.

The hazards lie not only in the problems of developing adequate models but also in the maintenance of a dialogue between public administrators and academics. If, in the quiet of a research environment, goals may be attributed to institutions with impunity, the heat of an operating program context will require of the participants a measure of objectivity seldom encountered. For example, the appropriate characterization of a local school system for modeling purposes depicts it as maximizing the off-duty and summer income of its regular teaching staff, a characterization not likely to endear an OEO Commission to the local school board, though it may in a model lead to the desired educational outcome.

Without minimizing the difficulties inherent in such undertakings, I would like to plead a case for a review of the relationship of the academic to day-to-day decision making at all levels in the administrative process, a review which could, hopefully, result in the integration of systematic—if arguable—models into the day-to-day administrative data collection processes.

The fundamental case for enmeshing modeling structures in administrative data collection systems must rest on the desirability of assessing directly the outcomes of the social action program. From a purely macroeconomic viewpoint, such outcomes are, by and large, irrelevant if the goals of the policy-maker have been achieved. On the other hand, social outcomes are often desired which are not measurable in purely income terms. We have only of late become aware of the dramatic impact of partial-equilibrium intervention on general-equilibrium ecological systems. Though we may hope otherwise, the approach of thirty public and private agencies to a small pocket of poverty may affect social outcomes in ways which may be better modeled by, say, a pollution model than by an irrigation model. One is led to ask to what extent the riots of the 1960's have resulted, at least in part, from the interaction of these several agencies attempting singly to move toward a socially desirable outcome, but, as a group, achieving precisely the opposite.

To a group which understands the "paradox of thrift," such perverse outcomes are not unknown.

It may be recognized, of course, that the current spread of the use of program planning and budgeting is directed toward rationalizing the internal structure of instruments and goals within particular government agencies. Such efforts are surely to be applauded. The next step would seem to call for explicit recognition of the actions and interactions of the agency in question with other agencies in the same environment. The general direction suggested by the advocates of the National Data Center would appear to be right. Unfortunately, it is not clear that much of the data collected by operating programs in social action areas is collected in response to the appropriate kinds of questions. On the other hand, if data collection efforts were rationalized along model building lines at the outset, such data banks as could be produced would be most useful. As a side benefit, a clear spelling out of the model for a particular agency's program would probably eliminate the need for the so-called "dossier files" which have bothered many who are concerned with the "invasion-of-privacy" question.

From yet another perspective, the promise of systems analysis will have to be redeemed if the programs and plans of the 1960's are not to appear in the year 2000 as the work of Fredrick Taylor and the "scientific managers" appears today. At base, that promise is a statement of the strength of a methodology. If my own reading of the advance of the social sciences is correct, it is an advance based on the assumption that the institutions being studied have explicitly definable goals. The economist not only has relied on that assumption, but surely the work of Festinger, Freud, Skinner, and others in the social sciences has been based on the same assumption. Even if large bodies of data on social interaction are collected with that assumption in mind, the outcomes of programs are by no means assured.

Finally, the evolution of federal statistical programs over the years suggests that the dialogue required for developing such programs to support legislative purposes has been important and fruitful. A similar institutionalization of dialogue between the administrators and academics on social action programs might well prove to be of even greater benefit. The agricultural sector, from the standpoint of an outsider, would appear to provide an interesting model of the type of working relationship which might be possible. It would seem that the fruitful interaction between scientist and practitioner is made possible by a recognition of common interest and a freedom of access to data significantly related to the problems faced by the practitioner.

ON THE NATURAL LAW OF HUMAN REPRODUCTION

By RICHARD A. LABARGE
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I

"The Catholic Problem," as it now is becoming known, has suffered a dearth of serious analysis, primarily for organizational reasons. Non-Catholics have tended to avoid it (except for unsympathetic attacks upon Church policy), partly because it is not directly their own problem and partly from a view that Church authorities might suspect and dismiss their work regardless of its purely logical merits.

Within the Church the problem generally has been approached with the usual tools of theology, notwithstanding the fact that its multidisciplinary dimensions extend far into the medical and behavioral sciences. The consequence has been a limited pattern of thought, for specialization in theology requires a lifetime commitment to studies in logic, scripture, history, legal precedent, and classical languages. Expertise in these areas necessarily comes at the expense and partial exclusion of equally important knowledge in such areas as medicine and the behavioral sciences where the lifetime demands for study and research are just as burdensome.

To say this is not a *tour de force*, designed and premeditated for the excuse of "new knowledge" as grounds for changing a Church policy with which the author disagrees. The sincere divergence of understanding on the problem is so great and so plain that the very forms of language used by clerics and nonclerics reflect the marked differences between the professions involved [1].

A further barrier to progress stems from the fact that some of the finest minds within the clergy feel strong pressure to avoid the problem because of its controversial nature. The Church is human enough to make its senior management appointments from personnel who demonstrate consistence in the virtues of prudence and loyalty. In the service of Christ, as in corporate or government service, obedience—not contention mixed with the scent of heresy—is the route to positions of responsibility.

Hence, we encounter all of the classic requisites for conflict and impasse: a difficult, multifaceted problem, serious emotional charge, and strong avoidance syndromes within those scholarly circles most qualified to deal with the problem. The result is maintenance by the Church of a public policy position on population questions which has serious eco-

nomic consequences, even though the bases of that policy generally are
viewed as noneconomic in nature. Professor Boulding has had a long
interest in the multidisciplinary aspects of conflict problems—particu-
larly in those with economic consequences—and it is because of his
great breadth beyond the restricted role of *economist qua economist* that
the Catholic problem is brought to the attention of the profession at this
meeting of the American Economic Association.

II

The origins and development of the Catholic problem already have
been traced with great care in the seminal work by John Thomas
Noonan, Jr. [2]. For our purposes it is adequate to note that the prob-
lem comes partly from scripture—Chapter 38 of the Book of Genesis—
and partly from interpretations of natural law to which the main portion
of this paper is addressed.

In the scriptural reference there appear two brothers, Her and Onan,
these being, respectively, the first and second sons of Juda, who earlier
had sold his brother Joseph into Egypt. Her marries a woman named
Thamar, but because of Her's wickedness the Lord has him slain before
any children are conceived. What happens next is best quoted directly
[3, p. 31]:

Then Juda said to Onan, "Go to your brother's wife, perform your duty as brother-in-law,
and raise up descendants for your brother." Onan knew that the descendants would not be his
own, so whenever he had relations with his brother's wife, he wasted his seed on the ground,
in order not to raise up descendants for his brother. What he did was evil in the sight of the
LORD, and he killed him also.

Now which action is the antecedent to which "what he did" refers?
For most non-Catholic Christians and non-Orthodox Jews, the "what
he did" which God punished was Onan's failure to fulfill family re-
sponsibility by refusing to raise heirs competitive to his own. On this
view, the wrong doing lay in Onan's general policy and attitude, not
in the specific act. But for both Catholics and Jewish Orthodoxy the
interpretation has been that God punished the specific act of "spilling
his seed," so that contraception in this form often is referred to in
clerical literature as onanism.

This paper makes no pretense of contribution to an argument which
must hinge largely upon questions of classical language structure,
authenticity of basic texts, and early Jewish law and practice. But if
the matter really was that important for the guidance of all men in all
times, why did God leave it vague enough to be the subject of honest
difference between scholars and reasonable men of good will? Surely it
would have been simple and clear to write, "and therefore the Lord
slew Onan as a warning to all men against spilling their seed," but
nothing like such text appears anywhere in divine revelation. Nor is
there anything remotely approximating a formal commandment:

"Thou shalt not spill thy seed." To leave question open on an issue of priority importance is an action which itself suggests a less than perfect or even malevolent Diety inconsistent with the Judeo-Christian concept of God. The alternative conclusion is that the issue probably was not that critical.

III

With the scriptural issue at best in doubt we turn to the main purpose of this paper: a discussion of the natural law aspects of human reproduction and the application of natural law to the Catholic problem. No comprehensive definition of natural law can be given, for only parts of the natural law are "known," and one never is really sure that "right reason" was applied in the derivation of this knowledge. But it generally is agreed that natural law possesses identifiable characteristics. One of these characteristics is universality, so that natural law principles should be knowable by and agreed to by all intelligent men of good will. Another characteristic is order, recognizing that more than one principle or set of principles is encompassed by so generic a concept as the laws of nature. Several writers [4] [5], particularly those in various University of Notre Dame conferences on natural law, envisage several levels of natural law, just as there are various levels of civil law. In the United States, for example, one thinks of a civil law pyramid extending from constitutional law at the apex down through an intermediate range of legislative enactments to the lowest-order levels of district or municipal ordinances. By the same token, natural law can be viewed as a pyramid of principles the most dominant of which are those which relate God to His creatures, the intermediate level of which relate creatures to one another, and the lowest level of which relate creatures to "things."

By inference, these very characteristics raise serious questions with respect to the use of natural law principles as the basis for proscribing contraception. In the first place there is nowhere near universal agreement on this position, so that it is most difficult to argue that the Church position is founded upon principles of universal knowledge, understanding, and acceptance. Of course, that argument can be made, but it is made at the cost of suggesting that all those who disagree with it either have malevolent intent or deficient mental capabilities. In an age of ecumenicism both implications are as gauche as they were unlikely even in the absence of an ecumenical spirit.

More important, however, is a widespread malaise that the existing Church position is incorrectly founded on a low-priority concept in the pyramid of natural law—that portion which relates creatures to "things" and reasons from the functions of "things." Professor J. J. Spengler summarized this criticism more than ten years ago during a

conversation with the author. His comment was: "There's a lot to this business of natural law when properly conceived, but this mechanistic stuff is nonsense!"

Let us examine the argument. The Church position is founded upon a concept of natural law which may be called the "frustration principle." The frustration principle states that "things" have a primary purpose for which they were designed by the Creator, and therefore any frustration of this function is a wrongful act. Note the application of this concept to the reproductive system in the classic encyclical on chaste marriage issued by Pope Pius XI in 1930 [6]:

... Since, therefore, the conjugal act is destined primarily by nature for the begetting of children, those who in exercising it deliberately frustrate its natural power and purpose sin against nature and commit a deed which is shameful and intrinsically vicious ....
... any use whatsoever of matrimony exercised in such a way that the act is deliberately frustrated in its natural power to generate life is an offense against the law of God and of nature ....

In syllogistic form the argument would appear as follows: Major premise: Frustration of a primary function is always wrong. Minor premise: The genitalia have procreation as their primary function. Conclusion: Frustration of procreation is always wrong. Note, however, that in spite of the strong encyclical language neither Pius XI nor any subsequent pope has gone so far as to define the frustration principle as an indisputable article of faith and morals. That prudence is justifiable, for definition *de fide* is a double-edged sword. It does compel belief by the faithful in the position taken, but if that position can be proved wrong, the very authority and divinity of the Church is called into question. In nearly 2,000 years the Church has yet to deliver so formidable a weapon into the hands of its detractors.

Some writers have questioned the validity of the minor premise in this syllogism with the argument that genitalia have other functions besides reproduction, some of which may be more primary and more important than reproduction. This question remains in debate. But the major premise, the frustration principle itself, also is subject to serious question, for it fails consistently upon extrapolation to other functions of the human organism. Consider the following assertions:

1. The primary function of the mental system is thought and guidance, so this function must never be frustrated.

2. The primary function of the alimentary tract is ingestion of food, so this function must never be frustrated.

3. The primary function of the respiratory system is absorption of oxygen, so this function must never be frustrated.

4. The primary function of the circulatory system is distribution of food and oxygen for bodily use, so this function must never be frustrated.

5. The primary function of the two elimination systems is removal of noxious residues, so this function must never be frustrated.

In each of these cases a system directly essential to survival of the organism is involved, and the penalty for prolonged frustration is clear enough and provided by nature itself without the necessity for encyclical clarification. But what lags are involved, even in these essential-system cases, between an act of frustration and imposition of the penalty? For what period of time and under what circumstances does the cessation of electrical charge activity in the brain imply death or measureable damage? Is it lawful ever to interrupt the alimentary tract, perhaps with the use of a clearly unnatural substitute like intravenous feeding? What is the moral position on collapsing a lung, seeing that this frustrates the function for which it was designed? For how long does the body remain alive and without serious damage if its heart is stopped by electrical shock for surgical purposes? Is it lawful ever to remove or otherwise interrupt the service of the kidneys?

Now one may argue that a temporary frustration of these five basic systems is different from permanent frustration, but to make this statement is an admission that any temporary form of contraception short of permanent sterilization would be equally proper under justifiable circumstances. Moreover, if one says further that the basic systems may be impaired in order to satisfy the higher good of overall health and well-being, it would be equally proper to apply that principle to less basic systems like the reproductive organs. Indeed, such is the usual consensus of most medical scientists, including some rather vocal ones of the Catholic persuasion [7].

But the extrapolation of the frustration principle may be extended further into secondary functions which, like reproduction, are not absolutely essential to immediate survival of the organism in question:

6. The primary function of the ocular system is sight, and this function must never be frustrated.

7. The primary function of the auditory system is hearing, and this function must never be frustrated.

8. The primary function of the muscular system is to provide motion, and this function must never be frustrated.

9. The primary functions of the nervous system are the communication of sensation and reaction, and these functions must never be frustrated.

In none of these cases is the natural penalty for even a permanent frustration of the function listed as severe as death—much less eternal damnation for mortal sin. Yet here a rigorous application of the frustration principle would forbid the use of eye patches, ear plugs, or traction and casts regardless of any higher "just cause" for the use of such de-

vices. The use of sedatives would be subject to the same debate as "the pills," for, like oral controls on the functioning of the reproductive organs, sedatives exercise internal control over (and perhaps frustration of) the nervous system. Would the Church condemn the Holy Father himself for the use of anesthesia during his recent gall bladder operation? If the major premise, the frustration principle, is correct, the purist would have to insist that the frustration of sensation could not be tolerated for any "just" or "higher" cause.

But there is an error of thought which underlies the major premise. It rests upon the view that any creation of God must perforce be perfect and that humans should not have the presumption to tamper with such apparatus or its functions. Yet the Church long since has dispelled this error in dealing with the problem of evil [8]. Question: How could a perfect God allow the existence of wrong in a perfect Creation? Answer: The greatest perfection requires imperfection in order to serve as a challenge for the development and growth of humanity, for no merit inheres in the outright gift of eternal reward. If this is true in the spiritual realm, why should the Church insist that it be false in the physical realm? Perhaps God has designed an imperfect human body with imperfect functional systems for the precise purpose of challenging human skill to develop and correct them. How many parents have often deliberately assembled a puzzle in error for the training of their children? And if this is the case, neither change nor frustration in any of the existing human systems would imply any criticism or censure of a perfect God.

This approach relieves the rigorous obligation toward pure mechanism which the frustration principle has imposed upon natural law thinking. The next step would be to move beyond the mere parts or "things" of humanity to discover and apply those principles in nature which govern in the intermediate and upper levels of the natural law pyramid—those natural relations proper between men and between God and men.

Following Boulding, this writer suspects that the diminution and minimization of conflict is a central concept in these upper levels of the law of nature. In the medical and behavioral sciences there already is strong evidence that uncontrolled population is a major vector of conflict, both inside family groups and at larger levels of social organization. There exists a need for the Church to give greater attention to this evidence in the universal quest for a universal peace.

REFERENCES

1. Leon Joseph Cardinal Suenens, *Love and Control, The Contemporary Problem* (Newman Press, 1961).
2. John Thomas Noonan, Jr., *Contraception: A Histoy of Its Treatment by the Catholic Theologians and Canonists* (Harvard Univ. Press, 1965).
3. *The Holy Bible with the Confraternity Text* (Good Counsel Pub. Co., 1961).
4. Yves R. Simon, *The Tradition of Natural Law* (Fordham Univ. Press, 1965).
5. *Natural Law Institute Proceedings*, Vols. 1–5 (Univ. of Notre Dame Press, 1947–51).
6. Anne Fremantle (ed.), *The Papal Encyclicals in Their Historical Context* (New American Library, 1956).
7. John Charles Rock, *The Time Has Come: A Catholic Doctor's Proposals to End the Battle Over Birth Control* (Alfred A. Knopf, 1963).
8. Thomas Aquinas, *On the Truth of the Catholic Faith (Summa Contra Gentiles), Book Three: Providence* (Doubleday and Co., Image Books, 1956).

DISCUSSION

JAMES D. SMITH: My comments are restricted to the papers presented by Professors Cooper and Hough. I feel more secure to leave Professor LaBarge's paper in the hands of my colleague Bill Neenan, whose background better prepares him to deal with the issues of natural law and the arguments of birth control within the Catholic Church. I will, however, raise one question in passing: Is the birth rate for U.S. Catholics significantly different than for non-Catholics if one first takes account of income level and age?

Both Hough and Cooper deal with the problems of data collection and the role of academics in the data collection process. Cooper strikes a sensitive cord. Much of what he has seen and heard (and smelled) in the shacks of the rural poor, I have experienced in urban slums and the Mississippi Delta. I do not draw all the same conclusions from my observations that he does, but both of us have a richer set of hypotheses to test for having had the clinical experience.

As Cooper is well aware, generalizations from clinical experiences must be cautiously made and tested by less personal techniques. But one thing comes through quite strongly: much of what is asked of low-income respondents in federal surveys does not sufficiently overlap their life-space.

In addition to the efficacy of the clinical approach as a pedagogical tool and an aid to the model builder, the methodology might well benefit the economist engaged in survey work. If prior to model and questionnaire design, researchers engaged in survey work would take the time to do some of the clinical work which Cooper has described, better questions would be asked and answers would be better interpreted. It is also likely that more resources would be put into the reduction of response errors, interviewer training and careful editing and processing, and far fewer resources put into sample size.

It has become fashionable, particularly in government, to work with very large samples, apparently in the belief that huge N's will improve the quality of data. For instance, the Current Population Survey of the Bureau of the Census has an N of 50,000 and last year only the good sense of Congress frustrated an effort by a government agency to field a sample survey with an N of 3,000,000! Larger N's do reduce sampling variability and increase the number of cells for which data can be published under the very conservative and often very paternalistic statistical posture of government agencies. But very large samples limit severely the flexibility of the survey process. Large numbers of interviewers whose abilities cannot command high wages must be used if interviews are to be completed in a compact period of time at a reasonable cost. Questionnaires must force answers into neat little boxes and highly automated computer processing is required to handle quickly the hundreds of thousands of bits of information collected from a large sample. System errors and programming mistakes, uncaught by careful checking, do not simply ruin a record or two, but repeat

themselves over and over throughout the entire set of collected information. An Orwellian computer-run-wild nightmare of bad data and skyrocketing repair costs can occur which would raise goose pimples on the flesh of a Morgenstern.

As Morgenstern (*On the Accuracy of Economic Observations*) has detailed, even an experienced agency such as the Census Bureau has produced its share of bad data. We can add a page or two to his book. In the processing of the March, 1966, supplement to the *Current Population Survey*, a processing error was made which allocated to persons for whom income was not reported the income reported by another person who had dissimilar occupational characteristics. For instance, the reported income of a self-employed professional might have been assigned to a laborer who refused to tell the interviewer his income. After the data had been published the error was detected, and subsequently the Census issued a few summary tables of corrected data. However, the bulk of the published data remains uncorrected, presumably because of the high cost of reprocessing such a large file. An even sadder tale is that of the 1966 Survey of Economic Opportunity conducted for OEO by the Bureau of the Census.

A tape file from that survey was received and made available to the scientific community in early 1967. Members of the Brookings Institution and others questioned the accuracy of the data. A subsequent comparison of the tape records to the completed questionnaires revealed that the information collected in the survey had not been faithfully recorded on the tape and that numerous other processing errors had occurred. By the time this tape file is corrected, it is estimated, two and one-half years will have passed and the final costs will exceed more than twice the originally estimated cost. The job of correcting the tape file, to be done by the Brookings Institution, is made difficult because many of the programs used to create the original file were not documented by the Census.

Hough laments the fact that academics are not sufficiently involved in the design of administrative statistical systems and do not have ready access to the output of such system. I share his concern. He has put his finger on one of the reasons why a stronger alliance between academics and bureaucrats may be fruitful. It is not necessarily that academics are smarter than bureaucrats, though I suspect it is so, but that bureaucrats are constrained by all manner of demand for nonscientific "responsible behavior," academics are much freer of such nonsense. Also, administrative statistics may be used to pass judgment on programs. The better the statistics, the sharper can be the judgment. It is hard for a captain to scuttle his own ship, but the act is sometimes needed. Better that some academic be ready to torpedo the vessel.

In the end, it seems to me, Professor Hough argues for an open federal statistical system—a system that at all levels is subject to the benefit of continuous academic scrutiny. My comments about the Census' problems support this point quite well. The Census sampling staff is of a superlative quality, they have continous contact with the academic community, and their work is well documented and highly respected. In short, they run an

open sampling operation. But who has ever seen a published documentation of the editing and computer processing of the *Current Population Survey* or other major Census surveys upon which so much federal policy and academic scholarship rests? These processing systems are essentially closed, and it is there that the problems have emerged.

WILLIAM B. NEENAN: Since I suspect I am a discussant because I am a Jesuit priest in addition to being by trade an economist, I will restrict my comments largely to Richard LaBarge's presentation. While sharing his evident misgiving with the natural law and scriptural arguments against contraception, which he describes, I feel his remarks are somewhat beside the point.

The elaborate arguments from a fundamentalist interpretation of scripture and a mechanistic notion of natural law against contraception, while they still undoubtedly constitute the "Catholic" problem in the area of population control, are no longer proposed by serious Catholic writers. There indeed remains considerable nostalgic attachment among certain groups to what was once a main citadel of orthodoxy. But it is my feeling that the Church has finally passed out of the age of citadels. Therefore to overrun one of these, as Mr. LaBarge has effectively done merely by describing it, may uncover only a straw fortress, inhabited by few real people.

For example, it is obvious that Onan was summarily punished by Yahweh for spilling his seed. But Onan's offense was not that of contraception but his refusal to have children by his brother's widow. Even when I studied theology, which was eons ago in theological history, Onan's sin was not "onanism." One standard Catholic commentary puts it this way: "There can be little doubt that in the intention of the narrators of the story the vice which Onan exhibits is not what is meant by the modern conception of 'onanism,' but his refusal to fulfill the duty of the levirate and to beget sons who should bear his brother's name." (John McKenzie, *Dictionary of the Bible*, p. 627.)

The legalistic terminology, "primary and secondary ends of marriage," once current in Church writings, was sedulously avoided by Vatican II in its discussion of marriage. The Council adopted a much more personalist tone in its discussion of the nature of marriage. This newer attitude has important implications for the question of birth control. The "Dutch Catechism," a work commissioned by the hierarchy of the Netherlands, reflects this new emphasis in the following statements under the heading, "Family Planning":

The propagation of the human race is not a task that falls at random to the lot of the family. Children are called into life in conscious love. Health, housing, personalities and countless other factors help parents to decide how large their family should be. No outsiders can really tell. One consideration of a more general nature is that the family should not be increased without a deep sense of responsibility towards the family itself and towards the world. But it must not be thought that this responsibility can be determined in any special way which would be valid for one and all. . . . The last word lies with the conscience, not with the doctor or the confessor. (*A New Catechism*, pp. 402–03).

I welcome these developments and anticipate they should have a long-

run impact on the population/poverty problem in Latin America and perhaps elsewhere. However, I would not expect them to have a dramatic impact on the extent of poverty in the United States. Although intelligent family planning programs have much to contribute to the solution of both the problem of poverty in the United States as well as other problems, such programs, even if highly successful, would not drastically reduce the extent of United States poverty.

According to recent estimates prepared by Mollie Orshansky, there were 6,086,000 "poor" families in the United States in 1966. Of these families, 931,000 had five or more children. But these large families with five or more children had so little income that even if they had all had only two children, their income level would still have been insufficient to raise 50 percent of them above the poverty line. Of course, a proposal which helps even a restricted number of families should not be set aside merely because it does not help all. And nearly half the poor children in the United States were in families with five or more youngsters. But it should be recognized that family limitation is only one among many approaches that must be taken. In fact, in the United States at the present time, it may not even have top priority.

Overattention to the family-limitation route to poverty alleviation may even distract us from the important lessons implicit in other data also reported by Mollie Orshansky. For example, in 1966, 35 percent of all families with a female head were poor and these constituted 22 percent of all poor families. Furthermore, 22 percent of all families with a head 65 years and over were poor and these constituted 25 percent of all poor families. But perhaps the most disturbing of these statistics of misery is that 3,020,000 families, or exactly 50 percent of all poor families in 1966, had a head of family who was employed in March, 1967. Presumably, therefore, vast numbers of the poor are willing and able to work for a living but cannot earn a living.

I think these data indicate that the attack on poverty must utilize not only family limitation programs, but must also give attention to the full range of income maintenance approaches currently being discussed, such as the negative income tax and family allowance programs, increased welfare payments, and enlarged human investment programs in education and health. In the last analysis, I suspect the most telling facet of the noneconomics of poverty is that when it comes to financing an attack on poverty we simply are cold of heart and faint of will.

HERMAN G. BERKMAN: Historically there has been a major concern with the contribution of overpopulation to problems of poverty. The Malthusian devils are still with us in many parts of the world. In some respects they exist in the rural underdeveloped enclosures within American cities and small towns out of the urban region. However, despite this, I think that the time is ripe to reflect on important new impacts which are now being taken more seriously: freedom of man, emancipation from authority, confidence in the ability of man to control his own destiny. In this light there are limits to

one man playing a god to another. Professor Cohnsteadt has enunciated this in his description of the frustration principle. This is a noneconomic aspect of poverty. For poverty can be measured in terms of inability to express oneself. Certainly, emphasis on enjoyment of life, that life is important is embedded in policies by government to render adequate services to those in need. This is the other method of attacking problems raised by poverty.

It is to this area that I would like to confine my comments. This might be particularly appropriate, since my training is in economics and I teach economics, particularly housing economics with respect to ghetto areas which are "colonies" within American cities in urban regions.

The reason for this noneconomic emphasis is that I am convinced that attitudes toward poverty groups and services made available to them tend to perpetuate conditions of poverty. Attitudes result from both the capitalistic enterprise system and prejudice against the black and those who have not "made it." In an article appearing in *Annals* for September, 1967, entitled, "Poverty, Inequality, and Conflict," the author lists six measurements of what might be called the several dimensions, some noneconomic, of poverty. Some economic dimensions of poverty are: income and assets which are indices, in part, of poverty. However, other dimensions must be measured in terms of: (1) basic services available; (2) social mobility, including changes in social respectability and acceptance; (3) educational mobility; (4) ability to obtain access to meaningful use of time in terms of work and leisure and life fulfillment; (5) productive use of time in terms of income and asset generation on a durable, long-term basis; (6) enrichment of political opportunity and posture. This includes the need for measures to assure self-development and some greater ability to control ones own destiny. Here the value structure of the "poverty" group must be endowed with sufficient political power to enable members of that group, just like other income classes, to express those values in indigenous social and economic institutions. Not only inequality in income and income-generating opportunity, inequality in ability to either accumulate assets or exercise power to obtain significant assets, and inequality in services available to those colonized in an enterprise economy including housing and health services, but inequality in educational experience and political power bases which will do more than simply enable absorption of the group within the entropic state of existing institutions—all lead to poverty of a far more important type—inequality in status and inequality in satisfaction.

What we are talking about is deprivation of a relative sort—a losing out which characterizes true poverty groups in an affluent society. If public policy is to be aimed at anything, we might consider the need to reduce inequities and reduce disparities in these six dimensions of which the traditional economist has only been interested in two. In terms of measuring ways to reduce these inequities which we need not spell out here, questions are: (1) How large an area of disparity should be allowed? (2) What are the means for changing monetary and status rewards besides generating motivation for achievement in only these terms? (3) In what ways can institutional arrangements and mechanisms that presently distribute rewards be modi-

fied? (4) To obtain such modification, how much conflict, agitation, distur-
bance and demonstration can be deemed acceptable?

I hesitate to use the term "countenanced" purposely. Measurement,
determination of data points to help answer these questions and to develop
a policy posture with respect to them are as essential as the establishment of
data points to determine policy now being developed in national, regional,
and urban economic accounting systems. For this reason current accents on
information systems are most interesting. Where data are collected now, it
is usually for three purposes: (1) demonstration of problem existence; (2)
justification for expenditure on an audit basis; (3) estimation of impact on
a discounted short-term cost-benefit basis.

On-going processes of public programs generally yield little data to eval-
uate progress. The short-term "unstable" character of many public action
programs makes evaluation of any sort almost impossible on any long-term
basis or substantial basis. Appraisal or monitoring of such programs is,
therefore, difficult. There are grave dangers in studying impacts of short-
range programs. Recent studies in the field of education offer examples.
Only over longer periods can we adequately appraise. Nevertheless, data
systems must be sought which will provide direction. Experience in three
symposia on applications of data processing to state and local functions held
at the Graduate School of Public Administration of New York University
reveal that administrative data and statistics can be of only limited utility
in research purposes.

Program evaluation requires a different set of models than those normally
required for operating administrative purposes. School attendance related
to state fiscal aid may be necessary for operating purposes but may not be
indicative of accomplishment—in meeting educational objectives. Costs of
maintenance of public housing programs may be necessary to understand
cost generators but cannot tell much, even as surrogates, in a cost-benefit
analysis of public housing management by either public or private manage-
ment of the accomplishment of public objectives of public housing programs.

Ideally, therefore, the same data system should serve research and opera-
tional purposes. Pragmatically this would be difficult. Full specification of a
data system is asking for perfection. Since data points point the way to
other data points, such a complete system would seem impossible to develop.
Dialogue between public administrators and academics must continue with
the academics taking the lead in developing sound systems of social accounts
with the difficulties being inevitable. Not only the academic must push for
sound data systems, but those in charge of policy and program review.

If this review were soundly based on study, it would be seen that a great
deal of what is important in terms of political equity is not based on policy
but on the administration of policy. The administration can and does nega-
tively amplify results. Recent examples are welfare systems as discussed by
Clower, Piven, and Senator Kennedy. Hence, needed are soundly built
public data systems which will expedite administration. More importantly,
however, are the development of the decision rules and models for decision
making that work on the questions we have previously noted.

Further, there is need to avoid administrative injustices such as expressed in many police systems and in housing and welfare administration. In their place the relationship of individuals to bureaucracies must be reexamined and the results of this reexamination embedded in restructured administrative systems on state, local, and national levels. Data collection based on existing practices is not as important as systems analysis necessary to restructure. For the way an official treats is as important as the laws officials purpose to administer. This qualitative treatment must be measured and studied through a sound management information system. This system must then be reorganized to assure sounder mission accomplishment.

Another point is perhaps in order here. Even as an economist, one should never consider profit-motivation and maximization as anything more than simplifying assumptions necessary for the construction of a heuristic model. Rational acts do not have to be based on the profit motivation. The system could be constructed so as to allow for "sentiment" as a frame for action. C. West Churchman has noted that no act can be considered outside the framework from which it is derived. There is no need for every one to be a profit-maximizing, profit-motivated man, especially in a society which faces the kinds of problems we do. Indeed, to instill in the poverty ridden such motivations assumes that the set of culturally derived economic institutions as now exist are not only the best, but perhaps the only ones. This cannot be proven. Indeed, increasingly large segments of the population want to change the economic institutions which they inherited and with which they are faced. Indeed, large-scale urbanized industrial society seems to be breeding the dropout. Social awkwardness is the mark of the dropout generally; he is the nonconformist. Surely creative federalism in a great society of creative capitalism can make "room" for all.

In this respect, the problem of those in rural poverty is not so different from those living in urban areas. For the poverty ridden in urban areas and in rural areas both are dropouts and misfits in a society where economic institutions can find no place for them. In both cases there is distrust of the established.

A clinical economist, I think, has the role of agent of change. There is a job of restructuring economic, social, and political institutions in both rural and urban areas. The role is to find out by listening, carefully, to ascertain what might be sensible ways to reorient our institutions so as to help individuals help themselves and not to make the individual conform, regardless of cost, to institutional requirements. New administrative arrangements must be worked out.

ECONOMIC REFORM IN EASTERN EUROPE AND THE U.S.S.R.

ECONOMIC REFORM IN THE U.S.S.R.

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Introduction

Many of us have surely grown skeptical of the possibility of really reforming the Soviet economy or changing its essential nature in any important way. Considering that the Russians have been engaged in economic reform for the last fifteen years and that the problems do not seem to change much, one wonders whether economic reform is not something of a hoax. The rationale for this paper must be some presumption that this time the Russians are serious about economic reform, and one of the tasks of my paper must be to consider that question. I also find it difficult to interpret the current reform measures as a movement from the command economy model to the market socialism model, and a second goal of my paper is to ask whether the Soviet leaders might not be moving toward a kind of system distinct from either of these. Finally, I want to explore a bit the political implications of the reform.

Principal Features of the Reform

A plenary session of the Central Committee in September, 1965, approved guidelines for dissolving the ramshackle structure of planning and administrative agencies which Khrushchev had set up and restoring the ministerial principle of organization, reforming the system of prices according to new principles, and altering the system of planning and controlling enterprise behavior. The general goals of these reforms might be summarized briefly as an attempt to give enterprise decision-makers more freedom to make decisions about resource use and to give them a reformed set of incentives and signals that would encourage them to use this new freedom in ways consistent with the general welfare. The "new system" can be most easily described in terms of an altered decision-making environment for the firm; the reform then involves the gradual transfer of enterprises and branches to this new system, a process which will not be completed until the end of 1968.

The new system alters somewhat the constraints and goals confronting the firm. The total number of plan indicators assigned from above

was cut and output is now measured by sales rather than by gross output. Rationalized incentives and independence are sought through a system of three incentive funds.

1. A "Fund for Material Stimulation" is formed in part from the enterprise's planned payroll as in the past, but that source is now supplemented with a portion of the profits earned by the enterprise, the amount depending on profit increases or sales increases over the previous year and on the rate of profit achieved. (Actually only a small fraction of the firms will have profit increases as the relevant indicator and for most, sales increases will be the success indicator.) For each percentage point increase in profit (or sales where that is the accepted success indicator) over the previous year, an amount equivalent to x percent of the enterprise's payroll is deducted into the fund. In addition, for each percentage point of profitability (i.e., net profit figured as a percentage of the annual average stock of capital employed in the enterprise) a second amount equal to y percent of the wage fund is deducted into the incentive fund. This dual system was established to permit the normativy to operate for several years. An enterprise might be expected to achieve big increases in profits in the first year or two after being put on the new system, but might find it rather harder to attain further profit increases in subsequent years, in which case the first component might soon be generating very small flows. In the process, however, the enterprise would have raised its profitability to a high rate, so that it would now be getting substantial flows from the second component.

2. A "Fund for Social-Cultural Measures and Housing Construction" is formed on the basis of the same success indicators, but with a distinct pair of normativy applied to the payroll. As its title suggests, this fund is to be used as a source of socialized bonuses in kind.

3. A "Fund for the Development of Production" is created from three sources, one of which is another pair of normativy tied to the same success indicators as those for the other incentive funds, but applied to the value of the firm's capital rather than to the payroll. A second source is a portion of the depreciation earned by the firm, which heretofore had been extracted into a central pool of investment resources. This fund also receives any revenue received from the sale of fixed assets. In combination with the fact that incentive deductions are tied to the rate of profit, this last provision is intended to induce enterprises to divest themselves of underutilized hoards of assets. They seem to have done so on a very large scale, even when as often happened they had to give the assets away! The Fund for the Development of Production then becomes a source out of which the enterprise can finance investment at its own discretion and on its own initiative, for adding a new production line, replacing obsolete machinery, and so on.

The discretionary investment potential provided by the Fund for the Development of Production is augmented with easier access to long-term bank credit, though there is still to be a considerable degree of centralized control over much of the investment financed by bank credit. Under the new system enterprises will also have easier access to short-term bank credit to cover working capital needs. In both cases, firms will be partially self-regulated in their resort to bank credit by the fact that they will have to pay interest to the bank on the borrowed funds.

Most enterprises under the new system pay to the treasury each year an amount equal to 6 percent of the average annual value of the assets, circulating and fixed, at undepreciated value, shown on their balance sheets. Certain assets are omitted from this total, and there is provision for the use of a 3 percent rate in some branches and complete remission of interest payments in others. Rent charges have also been established to extract the extraordinary profits of specially advantaged enterprises in branches where there is great cost variation among enterprises because of differences in situation. These rent charges differ somewhat from a Western conception of rent, since they are charges per unit of output rather than lump-sum amounts.

Under old prices, enterprises did not everywhere generate enough profit to pay the new charges, and to finance the new system of incentives. Hence the new system was applied in the first instance to individual enterprises and subbranches where profits were already high enough to support it, and the final transfer of all enterprises to the new system has only now been made possible by an economy-wide price reform on July 1, 1967. Although the price reform was conditioned in large part by the financial needs of the new system, it has also been used as the occasion to accommodate some new conceptions of how prices should be set to serve as guides to rational decision-making. In addition to the inclusion of rent and interest charges already described, these new ideas include a more sophisticated understanding of proper price relationships between substitutable goods, and the relevance of demand considerations. Reforms in economic institutions and practices over the past decade and a half have been paralleled on the theoretical and analytical plane by a revolution in economic theory, culminating in the adoption of standard modern value and allocation theory by at least a portion of the economics profession in the U.S.S.R. The new school of economists seems to have played only a modest role in the process of institutional and planning reform so far, but the conception of rational prices—referred to as the "prices of the optimal plan"—has been important in the thinking of the groups that have worked out the new price systems for individual branches.

In the beginning, apparently, this new system was intended only for the industrial sector of the economy. Since then, however, the same general principles have been extended in supplementary decrees to at least some of the enterprises in numerous other sectors as well—automobile transportation (*Ekonomicheskaia Gazeta*, 1967:5), retail trade, including eating establishments and consumer service establishments (*Pravda*, Sept. 13, 1967), railroads, water transportation, and the Moscow Metro (*Pravda*, Sept. 15, 1967), construction (*Pravda*, Aug. 1, 1967) and state farms (*Pravda*, Nov. 20, 1967). Analogous reforms have been made in scientific research establishments (*Biulleten Ministerstva vysshego i spetsializirovannogo srednego obrazovaniia*, 1967:7, pp. 2–3). The details differ, but in each case the same principle is followed of setting up incentive funds and decentralized investment funds based on successful performance according to some profit or sales indicator, and giving the management of the enterprise a smaller number of planned indicators and more room for independent decision making.

Critique of the New System

We need waste little time in a detailed critique of the measures described above or in trying to evaluate their success as shown by the performance of enterprises transferred to the new system. Much of the experience under the reform so far is surely transitory and evaluations made at this point are better filed in the wastebasket than in the pages of the *American Economic Review*. But I want to offer just enough of a critique to establish one crucial proposition; namely, that the reform measures so far introduced constitute neither a coherent system, nor a sufficient departure from the norms and behavior of the command economy to really solve the ills that prompted the reforms.

The independence and initiative from below that the new system is supposed to stimulate is much constrained by the fact that decision making still takes place in a context of physical rationing. In responding to the call to increase profit or sales, managers still have very little freedom with respect to the input or output mix. Although the number of indicators planned for the enterprise from above has been reduced, one of those retained is the output assortment in physical terms. On the input side, freedom to improve efficiency through substitution or to choose the cheapest source of supply is severely restricted by the fact of physical rationing. Centralized allocation is similarly a hindrance to "realizing" the new investment resources. The new system provides money but, as one manager explains, the true test of the procurement department's skill is still its ability to spend money without *fondy* and *nariady*. (*Ekonomicheskaia Gazeta*, 1967: 47, p. 11.)

The enterprise objective function under the new system is not the

simple maximization of profit that might conceivably make what is advantageous for society also advantageous for the individual *kollektiv*. My original description of the new success indicator system was over-simplified—in its full complexity it is an insanely baroque creation. The established *normativy* are tied to the planned magnitudes of the success indicators, and in the event a plant overfulfills or underfulfills the targets the *normativy* are adjusted by another set of coefficients. Given the trade-offs which this system sets up, an enterprise may find it to its advantage to propose an easy plan in order to overfulfill it, or an over-ambitious plan that it knows it will be able to fulfill only in part. It is claimed that tying the normative to the wage fund has discouraged cost-cutting reductions of the work force. Outsiders have usually objected that it would be more sensible simply to covenant with the enterprise to let it have some fixed proportion of whatever profit it earns, and then shift attention to rationalization of prices. Soviet commentators are now beginning to draw the same conclusion from the experience of enterprise response to the success indicator system.

For all the innovations it embodies, the new price system is still a hurriedly constructed and makeshift device. The reform was incomplete because its designers accepted a number of rather artificial constraints; e.g., that the terms of trade with agriculture and with households should not be altered under the new prices. (*Ekonomicheskaia Gazeta*, 1965: 45, p. 6.) This meant, for example, that the new relative prices of diesel fuel, gasoline, and residual fuel oil worked out earlier in a very sensible way by oil industry economists could not be achieved while simultaneously coordinating the price of residual fuel oil with coal and gas, and keeping the bill for motor fuel to the agricultural sector unchanged. So the notorious underpricing of diesel fuel continues.

The new charge for capital is a clumsy instrument. As a quasi-rent, the return to embodied capital should be price determined rather than price determining. If, as one suspects, there has been serious past misallocation of capital in the Soviet economy, true quasi-rents probably depart very considerably from the marginal efficiency of investment. In one of the relatively few contributions that the new economists seem to have made to the discussion of price reform as a concrete policy measure, L. V. Kantorovich made the very sensible suggestion that it would be much better to set prices according to some notion of the shadow prices of an optimal allocation, and then let the payment for capital emerge as a residual—perhaps zero in some cases. He argues this for railroads on the traditional decreasing cost basis, but also for machinery using a somewhat more complicated rationale. Machinery prices which omit interest on the tremendous capital accumulated in the industry as a result of overinvestment in the past would both encourage growth from

the demand side and force the machinery producers under the new system to get the extra output by better utilization of the capital they already have. With such prices they could not afford new investment on which they would have to pay the true opportunity cost of free capital. (*Ekonomicheskaia Gazeta*, 1965: 45, p. 9.) The decision to have a mostly uniform rate means that a subtle but powerful use of prices to improve decision making has been lost.

Levying the capital charge on the undepreciated value of assets may also have serious adverse consequences. For example, it is hard to think of a more literal case of sunk costs than past investment in an oil well, or a better illustration of the proposition that only variable costs are relevant to continued use of an asset. But since interest will have to be paid on old wells at 6 percent of their original cost, it will often be greatly to the advantage of an oil field administration to shut them down and get them off its balance sheet, to be replaced with new wells in more productive parts of the fields under its jurisdiction. (*Ekonomika neftedobyvaiushchei promyshlennosti*, 1967: 1, p. 9.)

Overriding everything else, finally, is the fundamental difficulty that reformed prices are still administered prices and not an item for negotiation in an environment of lateral negotiations between firms which the designers of the new system hope to create. Centrally fixed prices powerfully inhibit improvements that require joint decisions by more than one firm.

Unresolved Issues in the Reform

The above is not intended as a balanced analysis of the new system since in my view it is fruitless even to attempt any comprehensive evaluation. What clearly emerges from studying these two years' experience is that no new system exists, in the sense of a coherent set of new institutions, mechanisms, and policy instruments for which a blueprint exists and toward which the leaders are building. What is taking place is a revolution, partially guided by the leaders, but not founded on a clearly understood strategy. One of the most interesting questions about the reform concerns the dynamics of this process. During the two years that the Russians have been implementing the reform many things have happened also that don't fit in very well with the new system as originally expounded. The dynamic interaction of these forces and ideas creates a revolutionary potential in the reform and gives us some clue as to what kind of system might finally emerge.

The reform has created the conditons for a new allocation of powers between the ministry and other units under its general supervision—the *glavk*, the trust, the combine, the enterprise. If we take the original decrees at face value, it would appear that the leaders were junking

Khrushchev's organizational innovations to return to the tested branch system in its traditional form. The rationale for the reversion to ministries was that the development of branches required strong, unified leadership, and the ministry was the kind of organ to which the central planners could assign responsibility for branch innovation, investment, growth, and productivity. As the Russians have proceeded through the multifarious concrete measures required to put the reform into effect—such as drafting statutes on rights and responsibilities, assigning enterprises to ministries, and deciding whether firms should be consolidated—it has become clear that there is a strong pressure against recreating the pre-1957 system. If fully implemented, the new system would mean greatly increased autonomy for the enterprise, but those with a stake in strong powers for central organs are arguing very strongly that the enterprise cannot use independence wisely because it cannot see the whole picture. It is too small, for example, to do market research or to make sensible decisions on investment since it can't forecast demand and technical changes. But this argument is now being employed in a novel way to suggest that enterprises must be merged into larger units. The Russians had already been experimenting with such consolidations, though this campaign has waxed and waned. Many of the units formed were later dissolved. But there is now a renewed push for this kind of consolidation, sometimes through the creation of combines along the previous lines, sometimes by a process that makes what was formerly a supervisory organ such as a *glavk* into a head office with *khozraschet* independence. If all this weren't being discussed in the Russian language and the command economy jargon, we would have no hesitation in labeling it an oligopolistic "rationalization" movement. One would predict that both enterprises and ministries would have ambivalent reactions to such a cartelization movement. Despite its obvious threat to the enterprise, strong firms may still see it as a chance for increasing their power and gaining real autonomy vis-à-vis the party, their customers, or resurgent ministries. Higher agencies and officials, though they may see it as second best to the kind of power they would like to have, may sense that the old type ministry is gone and that this is their best hope against plant-level autonomy. The concern that many officials have about this reform is clearly revealed in a statement by the minister of the merchant marine in *Pravda* in which he lauds the reform, explains how they have put every ship on *khozraschet*, but then spends most of the article explaining the great potential advantages of having the comings and goings of the merchant marine controlled through a computerized center in the ministry.

The price reform affected or threatened to affect the distribution of

power and prestige and shows the interaction of economic reform and politics. Considering the power-distributive implications of the Kantorovich proposal for freight rates and machinery prices mentioned above, for example, it is not difficult to understand why this line of argument got such short shrift. There are numerous other incidents illustrating the potential of the reform for redistributing power and prestige, but I will describe only one in some detail.

The oil industry got out of the reform a greatly improved pricing system. Crude oil was previously sold under a system of settlement prices differentiated to meet cost variations among producers. The rent generated in this industry was collected by turnover tax only at the point of sale of finished products. Under the new system rent is being collected where it originates, i.e., largely in extraction, by establishing uniform regional purchase prices for crude oil. The price for any region is based on costs of the highest cost fields in that region that have prospects for expanding output. The new prices make possible rational internal margin calculations at the level of the individual field (when to abandon wells, whether intensification measures are worthwhile, etc.) and will lead the refineries and other consumers within the sector to make more rational decisions about their consumption of crude oil and intermediates. There was a problem in extending that system to Azerbaidzhan where some producers have extremely high costs. If the Azerbaidzhan regional price had been set to cover the costs of the marginal producer, it would have been far out of line with other regional prices. At the insistence of the Azerbaidjanis it was finally decided to permit them to use the old system of settlement prices, so that the regional price would be set at something like average cost of all producers, with individual producers paid according to cost. The Azerbaidjan producers must have sensed that in the new kind of environment a marginal cost price would expose their oil as uneconomic and threaten their growth prospects.

This incident is but one of many suggesting that the Russians are edging up to the normal situation in which money is power and distributes power so that prices become important. If the former ideological obstacles to rational pricing have been eroded, the political difficulties have become much more important, and the sensitivity of this issue is well shown in the reluctance with which it is discussed. The position taken by N. P. Fedorenko in a review of the progress of the reform that enterprises which cannot cover their current costs ought to be reconstructed or shut down is almost unique. (*Planovoe khoziaistvo,* 1967: 4, p. 14.)

Implementation of the reform has revealed an acute need for an improved system of contract law. An enterprise used to have a kind of

filial relationship to its "system" and faced the rest of the economy half hidden by the skirts of its *almum ministerstvo*. But it now faces increasingly the prospect of being out in the cold scrambling to make sales and profits—determinants of success from which there is going to be little appeal. It will have to look out for its own interests through obligations expressed in contracts and guaranteed by a legal system that will protect it against customers who won't pay up, suppliers who won't fulfill supply contracts, a superior organ which directs it to do things which are neither in its or society's interest. The present system of state and intrabranch arbitrage has either too circumscribed a jurisdiction to handle all problems or is a creature of the ministry in which it is hopeless for the enterprise to appear as plaintiff against its bosses. The most recent development is an attempt to try to fill the gap with a decree establishing draconian sanctions against suppliers for delayed or incomplete shipments and goods below the quality specified in contracts, those who fail to pay bills on time, against railroads for upsetting shipping schedules. (*Ekonomicheskaia Gazeta*, 1967: 47, pp. 3–4.) It is hard to believe, however, that this decree is an adequate answer—it will put a crushing burden on Gosarbitrazh and make the bank a battleground for intra-enterprise disputes, and is likely to open the door to a frightful outbreak of traditional Russian litigiousness.

At the time of the introduction of the reforms it was stated that the system of material-technical supply (i.e., rationing) would be retained, but that an eventual transition to a system of "wholesale trade" was intended. This promise is cautiously reiterated from time to time, but nothing like a tangible blueprint has ever been offered, and this is one area where there has been a palpable absence of bold experimentation.

The only exception that has come to my attention is the "no-limit system" for distribution of petroleum products (in operation since July, 1966, in Voronezh oblast, and extended in July, 1967, to nine additional oblasti). (*Ekonomicheskaia Gazeta*, 1967: 46, p. 9.)

Under this system the customers are supposed to advise the supply organization in advance of the amounts they expect to buy in a given quarter but are not obligated to take the whole amount requested or to stay within it. Very substantial reductions in amounts sold are reported, and this is explained by the disappearance of the temptation to fight for big allocations and to use up current allocations, wastefully if necessary, so that they will not be arbitrarily cut in a subsequent period. The significance of this experiment is its implication that rationing of petroleum products could be abandoned without fear of shortages. We have often been tempted to explain the Soviet material balance system as a consequence of the seller's market caused by the overcommitment of resources flowing from the ambitiousness of Soviet growth goals. But

this experiment suggests that the seller's market may be a myth, created and sustained by the material balance system that was established to cope with it.

One might argue that this conclusion might not have universal validity; i.e., that there may objectively be a surplus of petroleum products but not of all commodities. However, the conclusion certainly fits in with what a lot of separate studies have hinted at; namely, that the real drag on Russian growth is leakage of gross output into inflated intermediate consumption. A buyer's market would be a wonderful solvent for many of the sticky residues of the past: it would stimulate innovation and quality improvements, would generate commercial solicitude for the customer, and so on. But I repeat that the issue of rationing continues to be treated very evasively in discussions of the reform, and one suspects that it is so politically and ideologically sensitive a topic that only some very adept maneuvering will get it on the agenda for open discussion. Moreover, it will probably remain politically sensitive. If the final outcome of the reform is to be a cartelized production system, cartel managers probably prefer a seller's to buyer's market.

Conclusion

In concluding, I want to return to the questions raised at the beginning of my paper. If this is not a well-controlled transition to a clearly outlined new system, what will the end product be? Also, how does the reform affect political power and the political processes of the Soviet system?

I am not a very bold prophet, and on the first point will limit myself to the suggestion that it is not very productive from either the explicative or predictive point of view to continue our discussion in terms of the polar alternatives of a return to the command economy (perhaps in a computerized, optimal planning version) or an ultimate adoption of Lange-style market socialism. I doubt that it is possible to return to the command economy now, and for all its didactic usefulness in explaining the idea of decentralization through prices, the market socialism model is too full of ambiguities to permit reformers to pattern real institutions on it, and correspondingly for us to use in interpreting actual developments. (I have in mind here such traditional objections as its failure to explain how to make socialist managers abide by the rules when they have any significant degree of market control.)

The Soviet developments seem to offer confirmation of the idea of those who have studied the Eastern European reforms that reformed socialism may end up with a kind of industry cartel as its dominant institution. The industry level cartel would make investment and pricing decisions, handle marketing and forecasting, determine income dis-

tribution among its constituent publics, control innovation and so on. It would capture much of the present planning machinery for itself and although it would still work within a framework of central planning institutions, the policy instruments available to the latter would be much different from those now used and would involve such things as price regulation, tax policy, legal controls, chartering and licensing functions, and the like. (Note that I am not talking here about macro-economic instruments in the usual sense.) As a kind of socialist version of "the new industrial state," this is not a very attractive kind of system for economists to try to cope with. It is much more difficult to create neat simple models when the parameters confronting the main decision-makers are not prices, but legal controls over market power, or fiscal influences on decision making, and when the objective functions of the main decision-makers involve not only some simple measure like profit or output, but are an internalized amalgam of these with social conscience, ideology, and political ambition.

Closely correlated with this view of what the outcome may be is the other conclusion; i.e., that economic reform cannot help but be an active reagent in the process of political change. Interim steps in the reform (such as successive versions of the price reform) are less the result of moving toward a design the leaders know they must satisfy by a certain date than *ad hoc* reactions to pressures and difficulties that grow out of preceding steps and this situation offers a continuing chance for aggrandizement on the part of various groups. Traditional power relationships are being disturbed—relative power of big and little producers, of the entrepreneur and the rentier, the countryside in relation to the towns. Politically or socially determined status is to be challenged by the cash nexus. In short, things that count are up for grabs, and this probably includes the really fundamental thing: political power. This suspicion has been voiced by many observers. One of the things that I I had hoped to do but have hardly succeeded in doing was to analyze in detail how the reform might redistribute political power. Unfortunately, the economist who looks to the political scientists for some clear-cut model of Soviet politics must come away rather confused. But students of Soviet politics have always viewed the managerial class as a kind of competitor with the party for whatever it is that political power consists of. A recent book by Jeremy Azrael, *Managerial Power and Soviet Politics*, provides considerable substance for the proposition that the party has always seen the managerial class as a serious rival for power, and that it has never been able to solve that issue as clearly and permanently as it would like to. It does seem obvious that reform upsets whatever equilibrium had previously been achieved in this rivalry. There are many symptoms in addition to those already mentioned. In

the recent changes in statistical reporting rules, the steel industry and oil industry received what seem to me some very special concessions—a number of indicators formerly reported monthly now are reported only quarterly, including for the steel industry the blast furnace and steel furnace utilization figures, and for the oil industry drilling indicators. (*Ekonomicheskaia Gazeta*, 1967: 47, pp. 20–21.) Considering the role these have played as planning and control indicators, this is a real revolution. The exemption of the coal industry from the normal interest charges already mentioned is only one element in the generally distinctive application of the new system which the coal industry obtained. The decision to have a reform itself reflects the willingness of the party to hand over an area of decision making to the technical experts, but the reform as it progresses intensifies the process and calls for its extension into new areas, such as law and sociology. These examples may sound a bit farfetched and insufficient warrant for an assertion that the Party's monopoly of political power is being diminished. I must agree that they are only small symptoms, but they do involve the substance of what power consists of in the Soviet system, and I believe they are only symptoms of more significant but still unrevealed acquisitions of power already made by the managers and of still greater ones to come.

CZECHOSLOVAKIA: THE NEW MODEL OF
PLANNING AND MANAGEMENT*

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Encouraged by the economic expansion of the preceding decade, the Communist Party declared at its 12th Congress in July, 1960: "Socialism is victorious in our country. The transition from capitalism to Socialism has been completed successfully. A new era has begun. . . ."[1] Indeed, a new era was about to begin, but it was hardly the era envisioned by the Party.

Background of the Reform

According to official statistics, the national income grew at 5.9 percent per annum between 1950 and 1960 and virtually stagnated between 1961 and 1965. Industry, which had advanced at 7.1 percent per annum in the earlier period grew at 1.1 percent in the latter. Annual construction and total investment nearly tripled between 1950 and 1960 but declined between 1961 and 1965. Income originating in agriculture dropped by 4 percent between 1950 and 1960 and continued its decline in the 1960's. Inventories, already high in the 1950's accumulated still further, and so did the amount of unfinished construction. The full employment of the preceding decade turned into overemployment during the 1960's while capacities stood idle; the incremental gross capital output ratio became the highest in Europe, East or West.

The regime responded to these woes by an economic reform. The new system of planning and management, apart from frequent interim organizational changes, is the fourth system under which the Czechoslovak economy has operated since the second World War. The inauguration day, January 1, 1967, marked the twentieth anniversary of the Two Year Plan of Reconstruction and Development—an interesting and original attempt to manage some nationalized industries along with important private sectors [2]. The Soviet-type system was ushered in with the First Five Year Plan in 1949 and was modified in several important respects in 1958 and 1959 [5] [7]. This third system was abruptly ended in 1962 when the Third Five Year Plan (1961–65) was abandoned after eighteen months of operation, and a surprisingly lively and free discussion of a decentralized socialist market for Czecho-

[1] Quoted in [8], Dec. 23, 1965.

slovakia started. I shall concentrate on the economics of the new system as it emerged from the last four years of discussion and neglect the equally interesting social and political features of the reform.[2]

The New System

The individual provisions of the new system can best be understood as pragmatic responses to the difficulties which the economy experienced during the 1960's.[3] Under the new system, Czechoslovakia hopes to shift its development from the Soviet-type, extensive pattern which relied on rapid growth of the capital stock and on the increase and change in employment to the intensive pattern of technical advance and fuller utilization of existing factors. The centralized, all-embracing plan, which attempted to regulate every detail of economic life, has been supplanted by the socialist market. For the national enterprises and for the associations of national enterprises called "production-economic units,"[4] the plethora of success indicators has been replaced by net profit. The socialist state has not abdicated its powers over the economy. Indeed, the legal framework of the reform is broad enough to accommodate either a socialist market or a centralized command system. The state intends to achieve its economic goals: first, by retaining a few features of the command economy; second, by controlling wage rates and prices; third, by taxation, subsidies, and special levies; and fourth, by regulation of credit availability exercised through the State Bank.

The state plan remains the blueprint for economic development, but its character has changed. It still contains a number of fixed targets and binding limits concerned with the levels and the distributions of investment and of the labor force, with research, regional development, defense, state subsidies, and especially with foreign trade. However, the number of fixed targets has been reduced to a fraction of those in the former plan. Their place has been taken by the orientation indicators, which stress the forecasting element of today's plan. These indicators are summarized projections of individual enterprises' inputs and outputs designed to increase the level of information about the economy's needs and resources; they are not binding on the producing units.

The wage rates remain under centralized control of the state which

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[2] These aspects are discussed in [3] [4] [6].

[3] The best sources of information on the new system are the laws and statutes published in the *Sbírka zákonů* ("Collection of Laws") by the Ministry of Justice [1]. The most important ones are: Concerning administration and planning, 90/1965 (superseded by 100/1966), 132/1965, 14/1966, 63/1966, 64/1966, 69/1966, 83/1966, 118/1966, 137/1966, and 16/1967; concerning labor, 65/1965, 120/1965, 101/1966, 3/1967, 38/1967, and 86/1967; concerning prices, 8/1966 (superseded by 47/1967), and 32/1966; and concerning the State Bank, 117/1965, 85/1966, and 105/1966. The new system has been discussed at length in the *Plánované hospodářství, Finance a úvěr, Politická ekonomie,* and other periodicals. Especially useful for the practical aspects of the reform are the *Hospodářské noviny.*

[4] In Western terminology, the closest counterpart to "national enterprise" is the establishment, and to "association" the trust or holding company.

sets either definite wage scales or upper and lower wage limits, just as it did before the reform, but important changes have occurred in price formation and administration. After some experimentation with various types of supply prices for which the 1962 input-output table was used, the wholesale price structure has been revised for large groups of products on the basis of the 1965 cost data supplied by the enterprises. Price ratios within groups remain the same. The so-called "two-channels price formula" has been chosen: 22 percent of the wage bill and 6 percent of the value of depreciated fixed assets have been added to the average cost of production to determine the new wholesale price. The purpose of the price revision has been to make prices more realistic in relation to costs and to permit a uniform net value-added tax. These calculated prices are to be adjusted subsequently to demand. All other prices remain basically unchanged, although a possible revision of retail prices, consisting of making turnover taxes proportional to wholesale prices, has been discussed. The reform classifies all prices according to three categories. The first category consists of fixed prices, which includes raw materials, semifinished products, and some additional commodities that are important in determining the standard of living. The second category consists of prices that are permitted to change between upper and lower limits; it includes products with frequent changes in demand and assortment. The small third category consists of freely fluctuating prices; it includes articles of fashion and luxury items on one hand and low-quality products on the other, prototypes, models, and samples. The state retains the right to reclassify the products among the three categories and to freeze the price levels of the last two categories.

The state imposes a wide range of taxes on the national enterprises and the production-economic units. They pay a net value-added tax ranging from zero to 30 percent depending on activity and region; a 6 percent tax on the depreciated value of fixed assets and a 2 percent tax on inventories; and a modified depreciation charge on fixed assets in existence as of December 31, 1966. Furthermore, the enterprise pays the state an employment stabilization tax on part of the existing wage bill and on all wages paid to incremental workers. This tax amounts to 30 percent of the difference between the current wage bill and 9/10 of the 1966 average wage multiplied by current employment. For each incremental worker, the enterprise pays a tax which equals the current average wage.[5] All these tax rates are long-term policy tools and are set for the duration of the Five Year Plan. The state also directs the enter-

[5] The government sets numerous exceptions to the stabilization tax for specific industries and regions. For example, the tax is reduced for certain commodity groups within construction materials industry; it is supplemented by a surtax in locations with high-employment concentration.

prise to earmark part of its profits for payment into three funds: the reserve, the risk, and the cultural and social needs funds. As far as subsidies are concerned, the state supports certain goods where the price is under the costs, and it influences directly the investment activity of the enterprise by free investment grants. In contrast to the Soviet-type system, the grants are made for specific, well-defined purposes and are set in absolute amounts. It is the intention of the reformers to have the investment grants the exception rather than the rule.

The state controls the money supply and the credit through the State Bank. The bank has been elevated from an essentially auditing and accounting agency to a position of power and responsibility in the new system. The enterprises have to rely on it for both working capital and investment credit. The sums borrowed, which are intended to cover more than half of new investments, are repayable and the enterprises pay interest varying from 1 percent to 6 percent, depending on the industry and the purpose of the investment. The bank, taking into consideration the total volume of investment set in the plan, passes judgment on investment loan application by the enterprise. The bank considers the length of the loan and the expected rate of return, and it is free to refuse the application.

Let us turn now from the discussion of the goals and powers of the state to the national enterprises and the production-economic units that respond to its various rules and stimuli.

The national enterprise occupies an important position in the new system. Within the framework of the reduced number of fixed targets, the wage and price controls, taxes, subsidies, and credit management, the enterprise can produce what it chooses, enter freely into contracts with other entities to sell its products and to secure its material needs as well as labor and investment goods. The relationship between the employee and the enterprise is regulated in considerable detail by a collective agreement negotiated by an agency of the Revolutionary Trade Movement. While wage rates remain under direct control of the state, an important part of the take-home pay is scheduled to come from bonuses paid out of the net profit of the enterprise and thus depends upon its financial success. The enterprise guarantees its employee 92 percent of his wages. If the labor fund established from its earnings is not sufficient for such payment, the enterprise can transfer money from its reserve fund, ask for help from the association, or negotiate a loan from the State Bank. If an employee is released for reasons of economy, he is entitled to up to six months' wages severance pay. If the released employee, with the help of the enterprise and of the regional council, is unable to find suitable reemployment, he will be paid what the Czechs call a "contribution" amounting to 60 percent of his net pay; no time limit has been specified in the law for this socialist un-

employment insurance. The enterprise investment is financed by a part of depreciation allowances, from the investment fund created out of its net profits, or by direct state grants and bank borrowing discussed above.

While the national enterprises appear to have an important measure of autonomy, the executive organ of the production-economic unit called the "sectoral directorate" possesses great powers over the enterprises under its supervision. The directorate is "responsible for the long-term and effective development of the sector, coordinates the work of the subordinated enterprises and organizations, and enforces against them the interest of the sector as a whole" [1, 64/1966, § 1]. For these purposes, the directorate can impose levies on some enterprises and can subsidize others; it can set prices for transactions within the sector which are different from wholesale prices; it can influence important investment decisions of the enterprise by making recommendations to the State Bank, by aggregating the efforts of several of them into a common project and by permitting financial loans among them; and it can organize investment and research common to the whole sector. Furthermore, the sectoral directorate nominates and removes the enterprise director and issues the statute defining the relationship between the directorate and the enterprise. The statute regulates the distribution of the fixed targets and limits among the enterprises and sets up centralized funds into which they pay specific levies. Additional powers can be assumed by the directorate where "the economic effectiveness of centralized management can find clear expression" [1, 64/1966, § 1].

This is the essence of the new system. The actual system is, of course, considerably more complex. The laws provide numerous exemptions from stated rules, and the rules themselves are still in a state of flux. The life of the new system has been much too short to permit an empirical evaluation, but we can speculate on the likelihood of its success or failure. The reform is undoubtedly a forward step away from the Soviet model, which was conceived and developed in a large, self-sufficient country with a relatively simple industrial structure. Such a system was never suited for a small industrialized state with an inadequate raw material base and a heavy dependence on foreign trade. The limitations upon the new system which will affect its performance can be identified as those endogenous to the system and those due to the exogenous conditions within which it operates.

Limitations of the System: Endogenous

Important weaknesses may be found in the incentive system and the economic organization, in the price and wage systems, in the interrelationships within the entire system, and in the treatment of agriculture and foreign trade.

1. The architects of the reform intended to create a decentralized competitive economy. The organizational structure and the incentive system, however, are such that the behavior patterns are more likely to be those of highly imperfect markets. Each major commodity group is produced and sold by a limited number of national enterprises supervised by the same directorate with extensive powers. The profit maximizing enterprises, interested in bonuses for both managers and employees as well as in internal funds for reinvestment, are unlikely to engage in competition, and in fact the directorate, which is involved in the financial success of the subordinate enterprises, is a convenient place where "people of the same trade . . . meet together" [9, p. 130]. The Czech reformers are keenly aware of the monopolistic and oligopolistic elements in their markets, but they maintain that either foreign competition or direct state intervention will hold them in check. Their expectations, however, are not likely to be materialized. As for the former influence, the foreign sector continues to be separated from the domestic economy and the balance-of-payments difficulties, especially with the hard currency countries, will not permit foreign competition to play any role for years to come. As for the latter, arbitrary government intervention in the market is exactly what the reformers sought to avoid.

2. The new wholesale prices are more of a price revision than a reform. They remain purely supply prices, with little attention paid to demand conditions. They are based on cost data taken from the mid-1960's which was a period of serious disequilibria characterized by distorted wages, wasted material and fuel consumption, underutilization of capital stock, and a mixture of shortages and surpluses. The revision of prices—by including the cost of capital and by eliminating great disparities in profitability—was a step in the right direction, but the new wholesale prices cannot perform the tasks of structural transformation and improved efficiency expected from them by the reformers. Moreover, differential turnover taxes still deform the relationship of consumer prices to wholesale prices, and little has been done about agricultural and foreign trade prices. Finally, the pre-reform undifferentiated and distorted wage structure has been fully retained.

3. The suspicion of embodying disequilibrium applies not only to prices but to the whole system. The numerous taxes, levies, deductions, charges, and interest rates, differentiated by activity, by region, and by political considerations, are a very complicated set of essentially arbitrary figures. Because of the complexity of the Czechoslovak economy, a consistent set of interrelated figures could not have been developed via a "thorough discussion" in which the Czechs admittedly engaged. The amount of experimentation preceding the reform was limited in

time and scope, and the reformers had neither the necessary data nor the capacity to carry through calculations of quantitative estimates. Only by chance can the present set of figures be close enough to equilibrium so that small adjustments, which the reformers plan to make, would lead to consistency and efficiency. The existing Czech literature leaves the reader with the disconcerting feeling that the reformers underestimate or do not fully understand the complexity and the limitations of the free market as an economic institution.

4. The reform is particularly weak in agriculture and foreign trade. Czechoslovakia has paid a high price indeed for inadequate performance of her agriculture, in the form of large imports of foodstuffs and materials at unfavorable terms of trade. Besides providing a top-level reorganization, the reform applies to agriculture only slightly modified principles which were developed for such branches of the economy as industry and construction; agriculture needs more far-reaching changes to restore growth and achieve efficiency.

The reform leaves the foreign trade practically untouched; it remains a centrally controlled and managed element, disassociated from the rest of the economy. Such an arrangement is completely unsuitable for a country dependent on external trade and flexible adjustments to changes in foreign markets. The reformers realize this problem, and more has been written on the subject than on any other aspect of the reform. Yet the reform has sidestepped the problems of unrealistic exchange rates, inconvertibility, undesirable export and import patterns, lack of initiative to produce for exports, and the complete separation of foreign and domestic price levels.

Limitations of the System: Exogenous

The important unfavorable circumstances under which the new system operates are the domestic and the foreign economic conditions, the current Five Year Plan, and the training and attitude of the labor force.

1. The new system is expected to perform under domestic conditions which are considerably more difficult than the situation the centralized model was confronted with in the late 1940's and the 1950's. The situation outside Czechoslovakia is not more encouraging. Indeed, most of the apparent success of the centralized system during the 1950's can be explained by the strong demand within a completely protected market applied to underutilized and expanding capacities and a skilled labor force. The Soviet bloc nations needed Czech manufactures for reconstruction, the first flush of industrialization, and rearmament; in return, they were willing to supply Czechoslovakia with fuels, raw materials, and foodstuffs at favorable terms. The situation has been

completely different in the 1960's. The bloc nations have slowed down their industrialization drive; their own manufactures compete with Czech exports; and they can reach outside of the bloc for sophisticated, high-quality machinery the Czechs cannot match because their research and development has fallen behind. These nations can pay the West with exports of materials and foodstuffs, which have not suffered a comparable deterioration in quality. It is not machinery and consumer durables that are today hard goods within the bloc, but raw materials and foodstuffs, and the Czechs feel it.

2. The second constraint is the current Five Year Plan (1966-70) viewed as a manifestation of the state economic policy. More than anything else, the new system needs time and low pressure conditions to achieve its objectives. The plan provides neither; it wants more of everything. The financial and material sources and uses are, at least formally, balanced over the five-year period, but they are not balanced during the first two years. The plan is based on optimistic expectations of the untried and unproved efficiency of the new system. Sellers' markets prevail and inflationary pressures are perpetuated. These pressures have already necessitated a freezing of most prices during 1967, an increase of interest rate for working capital, an increase in the contribution of the enterprise to the reserve fund and in down-payment with the bank for the self-financed part of investment, a decrease in state subsidies and a redefinition of the taxable base for the net value-added tax. One cannot expect that meaningful economic relationships will be developed, efficiency fostered, quality improved, and the pressure on the balance of payments alleviated under high-pressure conditions. The improved growth rates and fulfillment of the plan in the past two years achieved largely by a further extensive development might be a Pyrrhic victory if the long-range goal of establishing an efficient socialist market is taken seriously.

3. Finally, the individual citizen has to decide if the new system represents a truly new era as claimed by its proponents or just another one of the reforms and reorganizations to which he has become well accustomed and indifferent. Undoubtedly, the threat of losing security and advantages gained under the command system will worry many worker, manager, and administrator. Greater freedoms given to the enterprises and greater responsibility in monetary management accorded to the bank will not be accepted automatically. The responsibilities of the new positions created by the system require a new breed of factory manager, socialist banker, market researcher, and other technical intelligentsia. No training ground for these new roles has been provided in the centralized system. More than in any other respect,

the heavy hand of what Egon Neuberger called the "legacy of central planning" shows in Czechoslovakia in the human element.

The Prospects of the System

The future of the Czechoslovak economy under the new system appears somewhat cloudy. The excitement of 1965 has been replaced by the sobriety of 1967. In addition to the economic complexity of the problem, the system itself represents a compromise between the economically desirable and the politically feasible. I believe that as of the end of 1967 the Czechs have not succeeded in creating a system which will bring about the desired goals of intensive growth. In defense of the Czech economic reformers, with whom I am in sympathy, I should point out that they face a Sisyphean task. It is one thing to regulate an existing free market by a set of crude rules like those the Czech reformers drew up; it is another problem to create a socialist market *de novo* on the ruins of a centrally planned economy in a country with a complicated industrial structure. The system needs more thought and experimentation. It may be successful if it is permitted to operate for some time, but it will be permitted to operate only if it is successful. The danger of a backslide into a centralized model is always present. Furthermore, the exogenous conditions under which the system has to work are difficult, to say the least, and not likely suddenly to improve. I do not want to imply that the Czechoslovak economy will come to a halt under the new system, but I expect its performance, at least in the next several years, to resemble more the performance of the 1960's than the performance during the 1950's.

REFERENCES

1. Czechoslovakia, Ministry of Justice, *Sbírka zákonů* ("Collection of Laws") (Prague, 1919–67).
2. Josef Goldmann and Josef Flek, *Planned Economy in Czechoslovakia* (Prague, 1949).
3. Václav Holešovský, "Czechoslovakia: Problems and Prospects," *Problems of Communism*, Sept.–Oct., 1965, 14, pp. 41–45.
4. ———, "Planning Reforms in Czechoslovakia" (mimeographed, accepted for publication by *Soviet Studies*).
5. John M. Montias, "A Plan for All Seasons," *Survey*, Apr., 1964, pp. 63–76.
6. ———, "Economic Reforms in Perspective," *Survey*, Apr., 1966, pp. 48–60.
7. Miroslav Rosický, "Organization and Management of Industry and Construction in the Czechoslovak Socialist Republic," *Czechoslovak Economic Papers*, No. 2, 1962, pp. 39–72.
8. *Rudé Právo* ("Red Right") (daily, Prague).
9. Adam Smith, *The Wealth of Nations*, Vol. 1, 3rd ed. (London: Methuen, 1922).

POLITICAL POWER AND ECONOMIC CHANGE
IN YUGOSLAVIA*

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Today discussion of Eastern Europe centers around the stalling of the reforms, the strong tendencies everywhere to postpone decisions on reorganization, or to eliminate the more radical proposals. The vision of developing market socialist economies throughout this area, including the Soviet Union, seems to be fading, and the reasons are everywhere the same: not so much fears that the reforms won't work or the inability of reformers to agree on a program, but rather fears that the political consequences of reforming may be unacceptable to the present leadership, that in some fundamental way markets and Communist parties don't mix. Of course, because the stalling seems to have such a strong political component, it is subject to change without much notice (as of March notice may have been served in Czechoslovakia), but such at least are the trends of the moment.

For some fifteen years now Yugoslavia has been operating an economic system that has been widely hailed as market socialist. In casting a rather opinionated and speculative glance over the course of institutional change in Yugoslavia in this essay we will bear in mind the economic reform issues that are now on the surface in Eastern Europe: price control, industrial organization, the control of labor, instruments for indirect economic control. But our main concern will be with the interaction of political power and economic change and the configuration of power that has resulted. In particular we seek to answer the question: in retrospect should the party have feared economic decentralization?

Political Change

A fundamental question, which casts its shadow over a great deal of economic decision making, is whether since the reforms of the early 1950's Yugoslavia has become more democratic. This is not an easy question to answer; one difficulty is that in characterizing political developments one would like to get behind the institutional forms to the realities of political decision making. This means, among other things, that the concept of democracy must be sufficiently pragmatic

to allow behavior that we find in our Western democracies; for example, it must allow the electorate in the overwhelming majority of cases to return the same people to office at the parliamentary level (about 90 percent in the United States), it need not require that candidates compete with one another by exposing their policy differences, the electorate need not be required substantially to change the policies of government more often than every twenty years or so (this happened for the last time in the United States in 1936 and that merely ratified a change already taken), or need it even be allowed to select the government that will rule (European multiparty systems using coalition governments), or need an effective opposition party exist (the United States in the first quarter of the nineteenth century).

Political theorists do not yet seem to have come up with a concise conception of democracy which would be capable of distinguishing among existing polities, concerned as they have often been with a very small number of boxes, frequently only two, and notions of ruling quite inapplicable to large-scale citizenries. So, rather than wrestling with political theory, let us instead take an *ad hoc* criterion: A polity will be said to have become more democratic, *ceteris paribus*, when the range of issues over which the government is challenged or can reasonably expect to be challenged expands, or when the intensity of challenge increases. By challenge is meant an attempt to defeat or substantially modify the proposal with some significant probability of success. This is not quite an operational cirterion, but it does contain a relevant distinction, and we will now try to use it by listing several ways in which Yugoslavia has become more democratic in recent years.

First, there is clearly an increasing challenge from parliament. This began in the late 1950's, taking a form which has since developed in some other Eastern European parliaments; namely, the technical revision of proposals as a result of closed sessions of parliamentary committees and commissions [6]. Since then the area of parliamentary challenge has been expanding by easy stages, a landmark of which was the rejection by parliament of the proposed annual plan for 1965 after extended discussion of quite a variety of modifications [5, pp. 2–3]. The discussion can now develop on the floor of parliament, and serious objections to government policies have occurred since 1965, as witness the discussion this year of the proposed law on the import of foreign capital [18, May 31, 1967, p. 6; June 27, 1967, p. 5].

Second, there is probably some challenge implicit in the growth of the number of contested elections. These were minimal throughout the 1950's, but occurred for quite a number of communal assemblymen by 1963 and were extended up the ladder for many republican and federal seats this year. It is claimed that there were some unexpected results,

among them the defeat of a minister of foreign trade. Many of the Serbian contests seem to have been hotly fought [13, Apr. 25, 1967, p. 3] [3, June 15, 1967, p. 6]. However, the nature of the challenge is rather unclear in these contests, since there is no formal opposition to the party line or to the party itself. But if it is true, as has been reported, that the Serbian party did not send down a list of acceptable candidates for many offices [12, June 8, 1967, p. 3], a precedent has been created which may well increase future challenges to the government.

A third and potentially even more important development is the appearance of at least informal bonds among two groups of political *aktivs* which reflects a dichotomy on major policy issues. The major economic issue dividing the two groups is the allocation of resources among republics by the government, with the more developed northwestern republics favoring productivity criteria and the less developed southeast equalization criteria. Many other economic issues, and especially that of the appropriate level of decentralization, have powerful impact on the effective criterion. These economic policy differences are strongly reinforced by the still pressing nationality problem, so that these fundamental social issues tend to be packaged in a way that makes compromise difficult [2] [21]. Thus two relatively cohesive factions have developed within the polity—and the party—factions which have already fought out several battles. Though the "liberal," "northern" faction has won two major battles in the 1960's, for liberal reforms and against the Ranković fraction of the faction, the war has not yet ended [20]. A consequence of the development of factions is a strengthening of the challenge to a wide variety of government proposals.

Finally, there is the opening of the society's communications. Foreign travel, especially to the West, has increased sharply both at the level of professionals and workers. In 1963, for example, there were perhaps 100,000 Yugoslavs working in Western Europe [8]. Border controls are much relaxed and over some borders (Austria and until recently Greece) there is quite free movement of the local population. Western periodicals and scholars circulate quite freely, at least in the cities. There is at least a kind of opposition press, in the sense of *Praxis* and similar journals, and even a counterpart of *Mad* magazine (which was recently subjected to an illegal form of censorship), and many of these publications have been subsidized by the federal government they criticize [11, July 22, 1967] [7, Aug. 12, 1967, p. 980]. Even the progovernment press offers extensive discussion of many economic issues before the political decision has actually been made, so that a public opinion with policy influence—the ability to develop a challenge to government proposals—may already exist in Yugoslavia.

We will not attempt to answer the question, is Yugoslavia today a

democracy, except to assert that she has more in common politically with Mexico than with Stalin's Russia. What is clear is that she has become substantially more democratic over the years since the reforms. Indeed, I can think of no significant way in which she has become less democratic, as defined, between say 1947 and 1967.

Marketization

The same problem arises in judging the extent of marketization in Yugoslavia as occurred in the last section with democracy. Theory provides us with models of markets but not with a good criterion for deciding whether they exist in a given empirical situation, particularly since the interesting question is again not whether but how much. In characterizing the development of markets one would like to get behind the institutional forms to the realities of economic decision making. The criterion of market existence must be pragmatic too; this means, for example, that the overwhelming majority of deliveries of a commodity from one enterprise to another must be allowed to be about the same in magnitude and terms in one period as in another. It means that sales of a given commodity must be allowed to be persistently made at different prices, whether because of the opportunity for discrimination or of imperfect market information. Prices must be allowed to be sticky and quantity adjustment to be the equilibrating device for some goods over periods of months or even years. There need be no simple relation between inventory change and price or quantity response; in particular, inventories may be allowed to accumulate over extended periods of time without any growth in demand. The market need not push enterprises onto efficient cost functions; in fact, they need not even come close [14]. And the government may impose a variety of restraints, explicit or implied, on enterprise decision making; for example, many firms may consider certain economically justifiable price changes politically infeasible. All these phenomena occur with some frequency on entities we typically call markets.

So again we have no clear basis for either/or judgments about the existence of markets in Yugoslavia, especially in view of the widespread use of informal controls, and are forced to turn to a criterion based on whether or not there has been a change in decision making: an economy will be said to have become more marketized, *ceteris paribus*, if over some range of issues government involvement in the decisions is reduced. Essentially, increasing government involvement means reducing the range of alternatives which the decision-maker considers to be feasible. Again the criterion is neither quite operational nor quite meaningless and will be applied to Yugoslavia in the same opinionated way as was the last one.

The major increase in marketization in Yugoslavia occurred quite early; namely, with the dismantling of the supply system in 1952. As a consequence the government was no longer involved in every major output decision. To some extent this was simply a ratification of the state of affairs of the preceding year or two, since the system of direct controls had faltered badly under conditions of industrial stagnation and the great uncertainties surrounding commodity availabilities. And to some extent informal controls of enterprise output policy continued for many years through various devices, of which the most important were probably direct control of foreign exchange by the National Bank and allocation of commodity imports through industrial associations. The government remained involved in a modest range of major output decisions but dropped out of involvement in the great majority of minor decisions [24, Chaps. 4, 6–7].

Local governments, which means nowadays mostly the communes, must play a somewhat ambivalent role in our criterion. Their involvement in enterprise decision making increased greatly with the introduction of the new economic system in the early 1950's, and they remain involved through their status as founders of many enterprises, as guarantors of minimum wages whatever the market conditions—and consequently as principal debtors in case of bankruptcy—and as continuing recipients of grants from local firms for various purposes. On the other hand, they are often allied with the enterprise in attempting to wrest improved conditions from government or other enterprises by obtaining further investment funds, rebates, or subsidies and the like. Consequently in dealing with local governments our criterion tends to vacillate between the "we" and the "they," depending on the issue.

Price controls in the producer goods sector were almost completely abandoned by early 1954. However, since that time the government has become much more involved in this range of economic decisions [24, Chap. 7]. Between 1954 and 1962 there was a steady trend toward expansion of the range of goods controlled until by the latter year more than two-thirds of the value of industrial goods transactions were controlled in some form [7, Dec. 21, 1963, p. 1520]. Since the 1965 reforms there has been a three-stage reduction in the controlled list, but in the summer of 1967 controls applied to about half the traded goods. One major step forward this year was the abolition of most trade margin controls, which, if they remain off, could lead to considerable improvement in the quality of distribution [3, June 17, 1967, p. 2] [7, Aug. 19, 1967, p. 1006].

Wage and labor controls have followed a steadier trend. Various wage control schemes of the 1950's were found wanting and by the early 1960's general wage control had been largely abandoned, though there

continues to be government involvement in a number of individual decisions and on one or two inflationary occasions general wage changes have been decreed. Government involvement in the hiring and firing of enterprise workers has also been reduced, and in the case of all but the top personnel the decision now is probably typically an internal matter for the enterprise, though the local government is often involved. The government is still involved in managerial appointments, but there is now a much wider range of choice for the enterprise and in many cases bodies beyond the local government are not involved. However, difficulties with labor policy during the recent industrial stagnation have probably involved government more deeply in this range of decisions than was the case a few years ago, and have also produced the interesting phenomenon of layoffs in worker-managed enterprises [7, Mar. 4, 1967, p. 263] [19, Aug. 18, 1967, p. 2] [3, Sept. 3, 1967, p. 11].

Credit policy to enterprises has been subject to considerable fluctuation. Early attempts to establish impersonal rules or auctions as allocative devices failed and until very recently direct control of the supply of credit at least to the larger enterprises was very common [15]. The recent reforms of the banking system are supposed to facilitate a shift to indirect government control of the lending banks and, at least for the time being, have probably reduced government involvement in this area somewhat [16].

The above examples indicate that over a wide range of issues there has been a considerable reduction in government involvement in economic decision making over the last fifteen years. It also suggests that after the initial steps were taken in the early 1950's changes in government involvement are quite mixed in direction. The latest reform was intended to be a large step toward further lessening in involvement, but its success at the present writing is by no means assured. A Yugoslav recently spoke of his economy as "a market without a market mechanism" [7, May 13, 1967, p. 593]. The principal areas of change since 1965 are supposed to be the elimination of various kinds of subsidies to "political" factories, the substantial substitution of world market competition for government price control and a large reduction in central government involvement in investment and welfare policies. Certainly steps in each of the three directions have actually been taken [1] [20]. Whether the new devices are sustainable or not remains in question. Part of the problem is that a government which relies on frequent reorganization as an instrument of economic policy cannot avoid creating expectations that another reorganization will soon be adopted, and these expectations lead to attempts by various interests to influence the next reorganization in their own favor, thus involving the government at a stroke in a very broad range of economic decisions.

And part of the problem is that, even without a general reorganization, it often seems feasible for interests to improve their position by getting modest changes in government rules. Some of these latter attempts in post-reform Yugoslavia are familiar to students of market economies elsewhere, as in the case of the steel smelters seeking and the foundries opposing higher tariffs on semifabricated imports, or the fertilizer industry's pleas for protection against dumping [3, June 27, 1967, p. 2] [7, July 22, 1967, p. 911] [12, Aug. 24, 1967, p. 1]. Others are somewhat novel, as in the case of strikes that are aimed at getting the government to relax its enterprise income distribution rules [18, Aug. 21, 1967, p. 6] [3, Sept. 6, 1967, p. 4; Sept. 10, 1967, p. 1; Sept. 16, 1967, p. 4]. But the market seems to be decreeing a harsh fate for many politically powerful entities in Yugoslavia—a fate that is certain to be resisted. In order to assess the force of this opposition, we turn now to the structure of economic interest groups in present-day Yugoslavia.

Interest Groups

The student of economic policy is often struck by the extent to which the nature of economic problems seems to impose a similar structure of interests among countries which have quite disparate social, political, and economic structures. Though this is also true of Yugoslavia, there are nevertheless several respects in which the structure of interests appears to be rather untypical.

First, and perhaps most striking, there is the absence of a rentier or stockholder interest in the population, a consequence of continued socialization of the means of production despite the reforms. However, perhaps the most important consequence of this lack is not political but technical: the inflexibility it imposes on monetary-fiscal policy, though even this problem is not irremediable (see below).

A second difference, which is unique in Eastern Europe, is the unusually strong formal articulation of regional interests. Local and republican governments have important decisions to make and a strong voice at the center on matters which are of regional concern. Cultural policy offers unusually strong support to regional diversity, and regional balance among officials and workers in most branches of the government is provided as a matter of policy. All this of course represents the regime's attempt to defuse the deep regional distrusts which are rooted in several generations of conflict. The regional interest in any significant problem in which the central government is involved will certainly be forcefully expressed to the government.

Also unusually well articulated, though for different reasons and not as compared with Eastern Europe, are industrial interests. There is a general industrial association and a variety of specific industrial associa-

tions (membership in the former being compulsory, the latter volun-
tary), not to mention the functional five-house parliamentary struc-
ture. This—superficially at least—syndicalist structure is clearly a
very important element in the Yugoslav "model" as perceived by the
leadership, since it has gone through a variety of transmutations over
the years but remains an important part of the organizational structure.
To a considerable extent it may simply reflect the emphasis on indus-
trial development which survived the end of the administrative system
by many years, and the consequent need to have an effective and compe-
tent chain of communication between enterprise and center while indus-
try was growing very rapidly. But partly it may also reflect doctrinal
considerations, which could as easily have come from the old *Ständestaat*
organization of the Empire via Astro-Marxism as from syndicalist
thought (on the former see [10, pp. 54–65, 320–38]).

Not so well organized formally, though it must often use the indus-
trial channels of communication, is the managerial elite—a group which
despite the increasing effectiveness of worker management remains a
distinct and powerful interest in contemporary Yugoslavia. Presumably
it has links of interest with many of the other higher professionals and,
as perhaps the chief representative of the legitimately successful, can be
expected to exert a somewhat conservatizing—but not necessarily
conservative—influence on policy.

The party and its creature, the Socialist Alliance, is badly split by
the conservative-liberal battles over the basic lines of economic and
social policy. In addition, the increased marketization and democratiza-
tion have tended to reduce the ability and the desire of enterprise and
commune level party officials to follow the central leadership line on
local issues. The party is no longer a monolithic hierarchy; nevertheless,
the party leadership still wields tremendous power in the party's name
and membership in the party is still essentially indispensable to entry
into a position of legitimate political influence.

Then there is the peasantry, whose interests have no real opportunity
to be articulated. Though the party exists in the village, it seems to in-
clude relatively few genuine peasants, as opposed to shopkeepers, tech-
nicians and employees living in the village (see, for example, [3, June 17,
1967, p. 2]). There is no indication that election contests have opened
up access to the government for the peasantry. Its interests continue to
make themselves felt mainly through the market, though even here the
cooperatives' procurement policies [3, Sept. 6, 1967, p. 4]—and PL 480
grain—have tended to mute its voice.

Finally, there is the parliamentary structure which, as noted above,
is becoming an increasingly effective articulator of interests. The range
of interests represented here is still restricted, but industry, region,

party—and of course government—have an effective voice. There are other means of interest articulation, such as the trade unions and the press, but perhaps the above remarks will serve to set the stage for a brief speculation on the implications of these changes in power and organization for future economic decisions.

The Structure of Issues

The trends précised in the first two sections suggest that the two kinds of developments, political and economic, may have been mutually reinforcing. On the political side, as the range of issues on which the government expects challenge expands, one may reasonably expect a tendency for the government to reduce, *ceteris paribus*, the number of proposals it makes, as a consequence of the increased decision costs. The administrative costs, of course, can be met by expanding the bureaucracy, and this has happened [22, p. 97], but the decisive costs are likely to be political: excessive challenge threatens to reduce the chances of survival or even legitimacy of the leadership. The use of tax policy as a partial substitute for direct output controls and, more recently, as a substitute for direct allocation of investment resources are examples of this reduction. So probably is the shift from credit and exchange rationing to much heavier reliance on indirect instruments of control of lending and exchange acquisition.

On the economic side, the selection of more aggregative and less direct instruments of control means that a given policy decision now has broader impact than before. The structure of issues thus tends to be changed in such a way that there is likely to develop both broad support and broad opposition to any policy that is not simply Pareto-optimal, and there aren't many of those. The new monetary policy is a leading example as is seen by comparing a decision not to grant additional credits to a firm or industrial branch with a decision to raise the commercial bank reserve requirements. Thus the new political environment tends to push the government toward the use of fewer instruments, while the new economic environment tends to push toward the growth of broader interest groups.

Recent trends may in this manner be actually reinforcing the sharp liberal-conservative, "German-Turkish" split—a split which was already deeply rooted in the structure of issues—so that a short-term solution does not seem to be in prospect. This does not mean that the issues cannot be compromised, or that total victory by one side or the other is inevitable, but it does make political decision making much more difficult. Perhaps the chief hope for a successful compromise lies in the fact that even here there is considerable overlapping of interests. Slovenia and Croatia contain a number of underdeveloped communes

whose future growth is threatened by any turning over of resource allocation to the "laws of supply and demand." And Serbia was the scene of the major factional contests in the 1967 elections, suggesting that there are strong forces there which are at least momentarily unwilling to commit themselves to support of a conservative-Serbian line.

Another factor influencing the decision structure is the existence of some institutional flaws. On the economic side, a principal one lies in the poor development of financial markets. The absence of debts and equities of producing organizations and the very inadequate development of commercial paper [15] [7, May 13, 1967, p. 593] introduces a rigidity into the system of money flows which must make indirect control of the economy rather more difficult. For example, so long as the government has so few financial options it cannot, while limiting itself to indirect control instruments, prevent a budgetary deficit from having an impact on the economy via the supply of money. It would seem that the quantity theory of money has something to say about the post-reform Yugoslav economy. Finally, a possible consequence of undeveloped exchange mechanisms is to introduce further variability into the lagged responses to an injection of money into the system, thus making the indirect controls still harder to operate effectively.

The new parliamentary system may contain a serious flaw in the obstacles it would seem to put in the way of interest aggregation. A bill must pass two houses in order to become law, one a general representation house, the other functionally based—for example, the annual plan must be passed both by the Federal Chamber and by the Economic Chamber, or a social insurance law by both the Federal Chamber and the Chamber of Social Welfare and Health. This division requires logrolling between houses when a possible compromise cuts across house competencies, while members of a particular house have rather limited incentive to pass a second-best bill when they do not vote on the other half of the compromise. It may be that this difficulty rather than the developing democracy was the primary reason for the much discussed fall of the Slovenian government a year ago (republics have a similar parliamentary structure) [17, Dec. 8, 1966, p. 26; Dec. 30, 1966, p. 23]. Flaws of this kind tend both to make economic reforms work less effectively and to magnify political differences.

If increasing democracy tends to produce increased political challenge, as it has in Yugoslavia in recent years, one possible result is greater hesitancy and perhaps inconsistency in government action. This, too, may have happened in Yugoslavia. For example, on paper the liberals seem to have won a number of major victories which had rather modest impact on actual government decisions. An official policy of decentralizing investment decisions was taken in the later 1950's under

liberal influence, but a study showed that around 80 percent of investment resources were still under *de facto* center control in 1960–61 [9]. And the removal of Ranković was accompanied by charges that his faction had been working systematically against the 1965 reforms [25]. Presumably it would not be argued that the development of well-organized interest group pressures will tend to enhance the consistency of government decisions. It may be that under such conditions there is no such thing as a politico-economic equilibrium.

Finally, there is the question of the stability of this structure. When it comes, the succession problem will be faced for the first time in the history of the Yugoslav Communist state. A flawed parliamentary structure, a sharp division of interests along regional lines, economic difficulties: if all these coincide with a succession crisis, who would care to predict the outcome? The party seems to have lost out relatively during the course of the last fifteen years to other burgeoning interests [12, June 1, 1967, p. 2]. So recent Yugoslav history suggests that Communist parties do have something to fear from reforms of this kind, though to some extent the Yugoslav leadership has encouraged this development, not merely endured it. Yugoslavia may be heading toward a kind of oligarchic rule by a revolutionary family (a term applied to Mexico by Frank Brandenburg [4]) which aggregates within itself the major interest groups, of which the party would be only one. But behind the party or oligarchy there lies some ultimate instrument of coercion to defend and legitimate the leadership. Apparently this is now the army, whose nationality structure becomes thereby a matter of some importance (for a complaint that too few Croats and Slovenes are adopting the army as a career see [3, June 15, 1967, p. 6]). Is the implied outcome, or range of outcomes, less likely to occur than the further evolution of Yugoslavia into a two-party democracy with a rather open market economy? It is unfortunate that, to the extent that these alternatives are subject to deliberate choice, they may be made, at least in part, on the basis of short-run performance of the economy, even though that short-run performance is largely irrelevant to the effectiveness with which the system of organization is functioning. A politician under challenge cannot always afford to take the long view. A "liberal" Yugoslav economy, which to a considerable extent will be exogenously driven by the condition of agricultural supply and export demand, is likely to be especially vulnerable to political challenge to its institutions during periods of economic difficulty, as long as major issues retain their present bivalent structure.

REFERENCES

1. George Bailey, "Titoism's Failure," *The Reporter* (New York), Jan. 26, 1967.
2. ———, "Where Titoism Was Tried," *The Reporter*, July 1, 1965.

3. *Borba* (Belgrade).
4. Frank Brandenburg, *The Making of Modern Mexico* (Prentice-Hall, 1964).
5. R. V. Burks and S. A. Stanković, "Yugoslavia: Toward Semi-free Elections?" (mimeo., Aug., 1966).
6. Vincent Chrypinski, "Legislative Committees in Polish Lawmaking," *Slavic Rev.*, June, 1966, pp. 247–58.
7. *Ekonomska politika* (Belgrade).
8. "European Migrant Workers in Western Europe 1961–1963," *Migration News* (Geneva), May–June, 1964, pp. 33–36.
9. Drago Gorupić, "Problemisistema kreditiranja investicija," *Ekonomski pregled* (Zagreb), 1962, pp. 463–80, 779–800; translated in *East European Economics* (New York), Spring, 1964.
10. Joseph H. Kaiser, *Die Repräsentation organisierter Interessen* (Duncker u. Humblot, Berlin, 1956).
11. *Književni novosti* (Belgrade).
12. *Komunist* (Belgrade).
13. *Le Monde* (Paris).
14. Harvey Leibenstein, "Allocative Efficiency vs. 'X-efficiency,'" *A. E. R.*, June, 1966, pp. 392–415.
15. Nikola Miljanić, *Novac i kredit* (Zagreb, Informator, 1964).
16. ———, "Regulisanje monetarnog volumena u SFR Jugoslaviji," *Univerzitet danas* (Belgrade), Nov.–Dec., 1966, pp. 121–35.
17. *New York Times.*
18. *Politika* (Belgrade).
19. *Rad* (Belgrade).
20. Rusinow Dennison, "Understanding the Yugoslav Reforms," *World Today* (London), Feb., 1967, pp. 71–79.
21. ———, "Yugoslavia's Problems with 'Market Socialism,'" American Universities Field Staff, *Reports Service*, Southeast Europe Series, Vol. 11, No. 4, 1964.
22. *Statistički godišnjak SFRJ, 1966* (Belgrade, 1966).
23. Miloš Vučković, "The Recent Development of the Money and Banking System of Yugoslavia," *J. P. E.*, Aug., 1963, pp. 363–77.
24. Benjamin Ward, "From Marx to Barone" (Ph.D. dissertation, Berkeley, 1956).
25. Marcus Wheeler, "The Yugoslav Political Reforms,"*World Today*, Nov., 1966, pp. 453–55.

DISCUSSION

ABRAM BERGSON: The thoughtful and informative papers that have been presented call for expressions more of gratitude than of dissent. I shall comment on only a few of the diverse issues that are posed.

What is market socialism? Just how does it differ from the alternative form of socialist planning with which it is usually contrasted: centralized planning? Our speakers refer to these concepts without much elaboration. Since the two kinds of socialist planning systems might be construed somewhat variously, perhaps I should explain that I think of market socialism as differing from centralized planning chiefly in respect of procedures used for determining inputs and outputs of production units. If I may quote from a recently published essay of mine ("Market Socialism Revisited," *J. P. E.*, Oct., 1967, p. 432), "under centralized planning such inputs and outputs typically are controlled to a marked degree by superior agencies in a bureaucratic structure through use of extra-market devices, such as physical quotas. Under market socialism, determination of factor inputs and outputs typically is left to authorities immediately in charge of production units, though superior agencies may still exercise much influence through manipulation of prices and other financial instruments."

To this I would now add that where prices and other financial instruments are used by superior agencies to control production units, market socialism also presupposes that these instruments not be highly discriminatory. The difference between market socialism and centralized planning would seem to narrow if, for example, superior agencies, while abstaining from imposing quotas on material inputs to different production units, should still charge such units very different prices for the same material.

All of this, I believe, conforms to the most usual understanding, but note that centralized planning and market socialism are considered here to represent a dichotomy, though decentralization and use of financial instruments may, of course, vary within each category. Professor Campbell, however, apparently prefers to think of the two systems as polar opposites. He is certainly free to do so, but he refers to a particular case which he considers as falling under neither centralist planning nor market socialism as usually understood: essentially important responsibilities are borne neither by bureaucratic agencies at a high level nor by production units, but by intermediate organizations, say, "cartels" of firms in a particular branch. It should be observed, therefore, that in his famous "competitive solution," Oskar Lange provided long ago for dual authorities of much the same sort as Campbell envisages: on the one hand, socialist firms responsible for current operations of individual plants; on the other, industry authorities in charge of large investments, especially introduction of new plants. Lange's competitive solution, of course, is usually considered as the outstanding theoretic example of market socialism.

Under the reforms in progress, how are the planning systems that are

emerging in the U.S.S.R., Czechoslovakia, and Yugoslavia to be characterized in terms of the two kinds of socialist planning as these are understood here? As Professor Ward makes clear, the Yugoslav planning system has been more complex than is often supposed, but I don't think he would object if I held that, even prior to recent reforms, it approached, if it did not actually exemplify, market socialism. The latest reforms apparently are intended to result in a still greater reliance on market-like procedures.

Before the current reforms, centralized planning, of course, prevailed in both the U.S.S.R. and Czechoslovakia. While I have differed somewhat from Professor Campbell's terminology, I can only endorse his account of the reform in progress in the Soviet Union. This is to say, that the changes being made are not nearly as dramatic as has been widely reported. The revisions are modest on paper and apparently more so in practice. As I see it, therefore, the Soviet system that is emerging is still a form of centralized planning. Within this category, however, a perceptible shift is occurring towards market-like arrangements, and so also towards market socialism.

As described by Professor Staller, the current reform in Czechoslovakia is decidedly bolder than that of the U.S.S.R. Perhaps the Czechs at long last are in a meaningful sense abandoning centralist planning for market socialism. Before we can properly interpret the Czech reform, however, we must have further information on aspects that are not yet entirely clear. For example, as Professor George Feiwel has stressed in a Harvard seminar talk and as Professor Staller also points out, the new prices that are being fixed will hardly be at clearing levels. To what extent will the rationing that must often result involve the continued imposition of quotas?

Will the market-like procedures that are being introduced in the three countries prove a permanent feature? What are the prospects that they will be resorted to, if anything, on an increasing scale in future? Campbell cautiously suggests that in the U.S.S.R. the most likely eventuality may be the cartelized type of planning system already mentioned. Staller does not commit himself on the prospects in Czechoslovakia. Ward is uncertain whether the latest changes in Yogoslavia will be sustainable, though he nowhere suggests that any major reversion to centralized extramarket procedures is in prospect.

For my part, I join with those who consider that there is an economic case for a shift from centralized planning to some form of market socialism in the U.S.S.R., to refer to the country that I know best. The case is admittedly rather theoretic and not exactly conclusive. Thus, how the Russians might fare economically under market socialism must be judged chiefly from analyses of notably abstract blueprints, including the competitive solution. As was brought out long ago and as further inquiry seems only to underline (see my article, cited above), an attempt to apply such a blueprint could encounter decided difficulties. For the U.S.S.R., the difficulties during a transition period might be the greater so far as the resource allocation patterns and prices inherited from centralized planning must often diverge widely from the equilibrium values that have to be sought.

The economic merit of market socialism may also be seen in the light of

the experience of Yogoslavia, but I doubt if I am alone in feeling that the available evidence on this experience is difficult to interpret—available evidence, that is, which includes many Yugoslav claims of success, many Yugoslav admissions of wholesale maladjustments and distortions, and the fact that the government itself finds it expedient to launch reorganization after reorganization.

Nevertheless, centralized planning in the U.S.S.R. is by all accounts notably inefficient. The Russians should be able to improve their performance in some degree by shifting to market socialism. I for one doubt that the advent of the electronic computer, potent as this instrument is, will much alter this equation in favor of centralized planning in the visible future. For familiar reasons, including the ever growing complexity of the economy, the trend may well be the reverse.

The prospects for market socialism in the Soviet Union, however, must also turn on how those in power there might respond to the economic case for it. We must consider, therefore, that while Soviet economics has as reported progressed much since Stalin, it still has its limitations. Moreover, among persons bred on Marxian ideology, resort to market-like procedures can scarcely be appealing in any event. Such ideology, however, has been eroding, and in part with the progress of economics. As Ward rightly stresses, Communist authorities everywhere are also sensitive to the loss of power and status that market-like arrangements threaten. To this rule, the Soviet authorities are no exception. Here perhaps the Yogoslav experience is instructive but, as described by Ward, it cannot be very reassuring to Communist rulers elsewhere. On the other hand, among some sophisticated proponents of reform such a change probably is valued for liberalizing polictical repercussions no less than for economic gains that are anticipated.

In sum, the most likely prospect in the U.S.S.R., I feel, is still further resort to market-like arrangements, but this is not at all certain, and we cannot rule out altogether reversals, or perhaps even the emergence of some cyclical pattern in which centralized and market-like arrangements simply alternate with each other without there being any very marked trend one way or the other. Such an eventuality is not entirely remote in circumstances such as those in question where there are conflicting goals, initial knowledge of the merits of alternatives is limited, trial-and-error is unavoidable, and because of the very complexity of things it is difficult to learn from experience. Indeed, though the causes must often be somewhat other than these, cyclical patterns of reorganization are not at all unknown in the annals of bureaucracy, including that of the U.S.S.R. The recent shifts between ministries and regional authorities are the most outstanding, but not by any means the only example. But intriguing as it is, this possibility could easily be overstressed, and I do not wish to do more than bring it to attention.

JOHN M. MONTIAS: The three national economic reforms so ably described in both their economic and political aspects in the papers by Campbell, Staller, and Ward may be studied in isolation or as a representative

sample of a larger group made up of all the institutional variants of socialist organization that have been tried out to date in Communist states. In addition to the basic "Stalinist" variant of the command economy, this group contains not only the newly refurbished systems of East Germany, Bulgaria, Hungary, and Rumania—the last two in an incipient stage—but also a number of earlier reforms that were abandoned for one reason or another: war communism and NEP in the Soviet Union, the abortive Polish and Czechoslovak reforms of 1958–59, and of course, the Chinese experiment with communes of the late 1950's, which may soon get a new lease on life.

In these brief comments I can only point out the most salient similarities and differences among the reforms. This is only a first but necessary step toward future comparisons capable of relating the level of development of a country or the extent of its participation in foreign trade to the economic model its leaders have selected (and particularly to the degree of decentralization they are willing to tolerate).

All East European reforms since 1958, together with the present Soviet reorganization, share at least two basic features in common: First, they all aim, or aimed, at a reduction of the minute, product-by-product coordinating tasks of the central planning agency, in favor of a greater emphasis on the maintenance of "correct proportions" in the intersectoral balance of the economy. Second, they reshaped the incentive system for enterprise management and created new financial arrangements designed to induce enterprises to comply with central plans and to raise the level of their efficiency, whether or not they were subject to the binding directives of higher authorities. Other reforms instrumental to these fundamental changes included the delegation of discretionary authority for marketing, supply, research and development, and other technical activities on an intermediate echelon in the economic administration, vested with a monopoly over a range of related products, supervising vertically or horizontally integrated enterprises, and itself usually on "economic cost accounting" (*khozraschet*); and the revision of producers' prices to bring them into line with production costs, however calculated.

The differences among the reforms turn essentially on the balance between detailed plan implementation and the action of "market forces," taken in the widest sense to connote all spontaneous untutored activity by subordinate units on cost accounting. These differences obviously show up in the presence or the absence of physical targets and limits and in the degree to which prices are dictated by a central agency; but they also emerge, more subtly, in the extent to which indirect inducements and incentives are used to press the enterprise toward the fulfillment of centrally ordained targets. The crucial test of the intensity of a reform is not whether what is "good for society" as esteemed by the planners has also been made profitable to the enterprise but whether the state is willing to recognize as valid, and even as socially desirable, actions taken by enterprises that conflict with the detailed provisions of the plan or that are not comprehended by any plan at all.

According to this general criterion, Yugoslavia carried out more far-reach-

ing reforms in 1952–53 than any other East European country before or since. For many years no central planning agency in Yugoslavia was endowed with coordinating functions; no material balances were drawn up; more than 50 percent of the value of industrial output was free of price controls; and, in the mid-1950's, long-term credits were auctioned off to enterprises submitting projects with the highest rate of return. The Yugoslavs retrogressed from these extremal positions in the late 1950's and early 1960's, but never enough to create a degree of central control comparable to that which has been retained in the new Czechoslovak and Hungarian systems, which are the most liberal and permissive in Eastern Europe outside of Yugoslavia today. But even in Yugoslavia, the principle of the identity of interests of enterprise and society was at all times subject to strict limitations: the Yugoslav leaders invoked the monopoly power of producers, the dangers of inflation, indivisibilities in investment projects, and the policy of subsidizing the development of the less developed republics as so many reasons for the state to intervene forcefully in the areas of price setting and investment allocation.

At the other end of the scale, the reforms in Rumania, Bulgaria, Poland, East Germany, and apparently in the U.S.S.R. itself have set no restraint on the central planners' discretionary authority. The plan they have promulgated and, if necessary, revised in the course of its implementation is still the norm according to which enterprise performance is assessed. The bargaining between higher and lower authorities over the tautness of the plan is now, or will soon be, transformed from a struggle over output and costs to one over income and profits. This type of game will be played as long as the center insists on total manipulation and control and refuses to countenance spontaneous, unplanned activity. Needless to say, the decision made in all three countries to maintain rigid administrative control over all prices fits in with this centralist conception of the reforms.[1]

The Czechoslovak reforms[2] of the mid-1960's, viewed in this light, exhibit a melange of the centralist and liberal conceptions of the new socialist model. Since these reforms are openended, as Staller points out, we shall have to wait a few years before we can evaluate their real significance. We shall see whether material rationing will be further curtailed or reextended, whether the scope of free producers' prices will be contracted (as it was early this year) or expanded, and, perhaps the most crucial test, whether the intermediate echelon—the sectoral administration—will revert to its tra-

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[1] The differences among these four national economic reforms reside in the leeway open to enterprises to enter into national and international contracts, in the formulae for centralized price-setting, and in other less important respects, but their points of resemblance are more fundamental than these divergences. Details on the Rumanian reform, the most recently announced of the four, are contained in the (draft) *Directives of the Central Committee of the Romanian Communist Party on the Perfecting of Management and Planning of the National Economy* (Agerpres, Bucharest, Oct., 1967).

[2] The reforms in Hungary, while they are too recent to permit detailed evaluation, appear to have many characteristics in common with those introduced in Czechoslovakia. The Hungarian reformers, it is said, are conscious and wish to eschew the compromises that have undermined the Czechoslovak reforms, but it is not yet clear whether they have been able to do so.

ditional function as a conveyor of central directives and controls or whether it will become the true representative of the interests of the enterprises in the productive economic unit (as in Yugoslavia). Historical antecedents would, if anything, point to the first alternative. In Poland, it did not take more than a year or two after the associations were created in 1959 for the traditional lines of force to resume their centripetal pull—a classic example of the spontaneous abrasion of a midway reform.[3]

Let me dwell finally on one aspect of the Czechoslovak reform that brings to light the delicate balance between liberal and centralist forces. Management incentives in the new Czech system are severed from plan fulfillment and tied to actual "disposable net revenue." The latter, as Staller points out, is derived from the value added by the enterprise after deduction of labor costs at standard wage rates, taxes, capital changes, and other minor payments.[4] Compared to the old system, which, whether via gross-output or labor productivity bonuses, biased managers toward material intensive production processes, the disposable net-revenue criterion created an incentive for enterprises to shift to more labor intensive processes and to economize on materials. The extent of this substitution was not anticipated by the central authorities in 1966 and 1967. It also happens that the new producers' prices of 1967 were built up from padded costs estimates. For these two reasons, enterprises accumulated appreciably larger disposable funds for distribution to staff and management and for capital expansion than the financial plans provided for, while the planned wage fund was exceeded. Enterprises had more funds at their disposal for investment than there was machinery available or free construction capacity to realize their intentions.[5] Wage earners received incomes in excess of the "consumption fund." To restore equilibrium in both markets, the authorities faced a choice. They could either confiscate some of the enterprise funds accumulated and/or penalize the distribution of bonuses and extra wages by taxation. Or they could accept these unforeseen developments, revise their plans, and support the forces at work in the system by letting resources flow to the excess demand sectors. Some of these resources might be generated from the foreign exchange and labor released by the economies of materials, others by scaling down centralized investments. Despite some opposition and complaints by economists fearful of recentralization, the authorities resorted mainly to the first alternative, though perhaps more for reasons of convenience and habit than from any design of subverting the reforms. It would take a stronger sense of urgency and purpose in pursuance of decentralization than the Czechoslovak Party leaders possess at the moment to have opted for the second course. That the choice was debated at all is already symptomatic of a change in the political-economic climate that has taken place in the country.

[3] On recentralizing tendencies, see Gregory Grossman, "Economic Reforms: A Balance Sheet," *Problems of Communism*, Vol. XV, No. 6, 1966, p. 54.
[4] For further details, see V. Holešovský, "Financial Aspects of the Czechoslovak Economic Reforms," a paper presented to the workshop on "Money and Finance in Communist Countries," Berkeley, Dec., 1966, p. 920.
[5] See *Hospodářské noviny*, Nos. 39 and 42, 1967.

INTERNATIONAL LIQUIDITY

THE PRESENT STATE OF INTERNATIONAL LIQUIDITY THEORY

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"Half-baked theory is not of much value in practice, though it may be half-way towards final perfection."—J. M. KEYNES.

International liquidity, like marital bliss, is a term that everyone uses but few understand. To avoid devoting most of our paper to insoluble semantic questions (which would in any case only reveal that we were in the majority), we shall restrict our review to that portion of the literature that is specifically concerned with the adequacy of international financial reserves.

I. *Reserve Needs: General Considerations*

Official holdings of foreign reserves derive from attempts by national authorities to maintain fixed rates of exchange between domestic and foreign currencies. In a world where all currencies were backed 100 percent by a single commodity such as gold, or where all exchange rates were freely flexible, every national currency could be used to discharge trading debts in any country. Where rates of exchange are fixed by government fiat, however, or where fiduciary issues are pegged in relation to other currencies or to gold, different currencies are substitutable as media of exchange only as long as each is freely obtainable at prevailing rates in all countries. The latter condition can be satisfied continuously only if national authorities assume major responsibility for the purchase, sale, and holding of foreign currencies and simultaneously pursue policies of economic control that enable them to maintain reserves at levels that permit all demands to be met.

A person who insisted on eating meals while standing on his head clearly would have problems. If he sought our help, we should probably suggest that he adopt a more convenient posture. Many economists are inclined to offer similar advice to central bankers and other perplexed managers of international reserves. If governments insist on maintaining their present stance in international financial affairs, however, the necessity of reserves must be granted and the question arises, "By what criteria, if any, may a country arrive at a reasoned judgment about the adequacy of its existing reserves?"

Professor Machlup has suggested, not altogether facetiously, that judgments about adequacy are at best quixotic: "... the 'need' for

reserves is determined by the ambitions of . . . monetary authorities."[1] There is no doubt much to be said for this view; but before concluding that problems of reserve adequacy are more appropriately discussed by psychiatrists than economists, we must see if any of the reasons for holding reserves is amenable to rational assessment.

Under a system of flexible rates, individuals engaged in foreign trade would hold foreign currency for much the same transactions, precautionary, and speculative purposes as they would hold domestic currency. None of the basic needs for foreign reserves would disappear under a system of fixed exchange rates. Centralization of private precautionary and speculative balances might involve some reduction in total reserve requirements. But government officials tend to think more in terms of shibboleths and conventions than in terms of social costs and benefits, so rather than permit temporary variations in reserves to be evened out by appropriate rate variations around established levels, official managers are likely to hold extra reserves sufficient to meet temporary drains head on. In a system of pegged rates, however, additional reserves typically would be held to ward off potential attacks by foreign and domestic speculators.[2] Indeed, to avoid recurrent speculative crises arising out of short-run movements in reserves, official balances held for "war-chest" purposes alone might well be maintained at a level several times as large as aggregate holdings under an otherwise identical system with flexible rates. Professor Machlup's theory of monetary reserves should perhaps be modified, then, to assert that needs are determined by the nightmares as well as by the ambitions of central bankers.

It should be clear from the foregoing discussion that the adequacy of reserves to meet some contingencies cannot be assessed in terms of reasoned criteria. However that may be, it is surely important to distinguish conceptually between reserves that are needed to facilitate trade and reserves that authorities desire for other reasons. For purposes of discussion, it is convenient to distinguish four main reasons for holding official reserves. The first and most obvious reason is to accommodate systematic and random fluctuations in current account receipts and payments. The second reason is to allow for temporary nonspeculative

[1] Fritz Machlup, "The Need for Monetary Reserves," *Princeton Reprints in International Finance*, No. 5 (Oct., 1966), p. 27. The cited passage provides only a partial statement of a more general doctrine known as "the Mrs. Machlup's Wardrobe Theory of Monetary Reserves."

[2] The role of gold in international trade merits brief comment in this connection. In a world of flexible prices and exchange rates, gold would occupy no special place as an international means of payment. A similar observation applies to a system of fixed exchange rates, provided that no country pegs its currency to gold. If a country is so ill-advised as to introduce (or maintain) such a peg, however, the effect is to create an extraneous "international money" and an equally extraneous "exchange rate." Speculators may then use the first as a weapon to attack the target provided by the second. Hence there arises not only a need for reserves but for reserves of gold. As if standing on one's head to eat were not enough, one hand is now tied as well.

variations in capital account items. The third reason is to buy time when a country finds itself in fundamental disequilibrium—time to determine whether or not such a situation exists, time to decide by how much prevailing exchange rates should be altered, time to devise domestic policies that will maximize the effectiveness of the proposed changes. The fourth and final reason is to enable a country to weather speculative storms.

Judgments about the adequacy of reserves held for the first two reasons clearly fall within the ambit of economic analysis. However, only a very minor fraction of the literature is specifically concerned with these requirements, and most of that fraction is basically exploratory. Judgments about the adequacy of reserves held to buy time belong partly within the province of economics, partly within that of politics and social psychology. The great bulk of the literature on international reserves is concerned directly or indirectly with such judgments.[3] Since most of these contributions barely rise above the level of social conversation, we shall have little to say about them in what follows.

The adequacy of reserves held to meet speculative crises has so far not proven amenable to rational assessment. We suspect that this will always prove to be the case since speculative crises are never wholly rational affairs themselves. If this is correct, we shall never be able to arrive at operationally meaningful measures of overall reserve adequacy. Speculative behavior as a routine aspect of merchandise and other nonspeculative trading activities is, of course, a legitimate object of inquiry in connection with the first two reasons for holding reserves. Speculative crises are in the nature of electrical fires, however: protection lies not in better insulation but in new wiring.

II. *Measures of Reserve Adequacy*

It is important to distinguish between qualitative and quantitative concepts of reserve adequacy. Qualitative concepts—measured by ratios of reserves to imports, exports, net overall trade balance, or the variance of reserves—are not without interest for descriptive and comparative purposes but are of no direct use for analytical, predictive, or policy purposes. Quantitative concepts—measured by estimates of the probability that any given quantity of reserves will suffice to meet reserve needs during a given time interval—are apparently necessary if we are to pursue the problem of reserve adequacy beyond the stage of statistical anecdote.

To arrive at empirically meaningful measures of quantitative adequacy is a regrettably difficult task. As is true of any econometric

[3] For a representative sample, see Herbert G. Grubel, *World Monetary Reform* (Stanford Univ. Press, 1964).

analysis, we must begin by formulating an explicit statistical model to represent the processes that are assumed to generate relevant time series data. If this step is to constitute anything more than a theoretical exercise, the model next must be estimated and shown to yield results that accord satisfactorily with historical experience. The derivation of appropriate measures of reserve adequacy, either by direct calculation or by indirect simulation techniques, can then be carried out to some purpose.

When we specify a model we have to isolate the reasons being studied for holding reserves. The main reason analyzed so far, and the one to which we shall confine ourselves in this section, concerns transaction balances used to accommodate systematic and random fluctuations in current account receipts and payments. The following is a typical set of isolating assumptions: (1) a small country, (2) trading at fixed import prices and a fixed exchange rate, (3) no autonomous capital movements, (4) fundamental equilibrium rules so that the equilibrium rate is unchanging through time and is equal to the official rate, (5) receipts and payments are subject to disturbances[4] such that reserves vary over time. A critical assumption must then be made over (5): either the disturbances are random in time or they are in some way serially correlated.[5]

Having specified a model, it is necessary to ask precise questions of it. One approach is to ask what is the probability under stated conditions (including an initial level of reserves R_o) that reserves will fall below some stated level $L(L \geq 0)$ at some time between the present and some finite future date T. This approach fits naturally into the theory of random walks. Specifically, we have to calculate the probability that a particle, starting at a level R_o and moving in a series of discrete steps (each equal to the expected value of a one-period gain or loss[6]) will fall below a line with ordinate L at any time on or before date T.[7]

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[4] It is important to observe that balance-of-payments figures measure transactions and not payments (cf. Leland B. Yeager, *International Monetary Relations*, Harper and Row, 1966, Chap. 3, esp. pp. 36–37). Thus fluctuations in the current account balance will greatly overstate fluctuations in net current account payments whenever traders indulge in stabilizing behavior (e.g., by postponing repatriation of funds from abroad and accelerating payment to foreign points whenever they think the current rate is too high). Data on official reserves are free of this particular defect since they reflect payments rather than transactions; but they have other faults since they show the net effect of autonomous capital transactions as well as and inseparably from that of current account transactions.

[5] It is worth noting that the argument that export and import transactions are subject to thousands of independent causal forces (see, e.g., Kenen and Yudin, as cited below, p. 244, n) would not establish serial independence and a normal distribution for payments and receipts even if it did establish it for transactions. The actual purchase and sale of currency does not have to be synchronized with transactions; hence, both purchases and sales may be significantly affected by an important common cause: the relation between the current rate of exchange and the expected future rate.

[6] The more accurate formulation is for the magnitude of each step to be determined by a random drawing from a normal distribution. For long walks, the expected value of the one period change can be used, giving a substantial simplification of the analysis. For short walks,

The second approach is to determine some optimal level of reserves and then to compare actual with optimal levels. As we shall see, this poses more difficult problems than merely calculating the probability of reserves falling to some crisis level.

Needless to say, practice as reflected in contributions to the literature conforms imperfectly with these precepts. Economic theory furnishes few tools for explicit treatment of disequilibrium processes of the kind that characterize trading in a system of inflexible exchange rates. In the present state of economic science, one must either rely on *ad hoc* theoretical models or (what comes to much the same thing, only more obviously) choose an equation with convenient statistical properties and attempt to rationalize the choice after it has been fitted to data.

Early empirical work was based mainly on ratio comparisons, the implicit theory being that the need for reserves was related to some level such as that of imports or exports. These measures have been reviewed critically by Machlup.[8] In order to go beyond purely qualitative measures it is essential to realize that the job reserves have to do is related to variability rather than the level of receipts and payments. Caves[9] seems to be the first person to have stated this publicly. A transitional step in the same direction is taken by Weir M. Brown,[10] who hints at Caves's point but who is still so wedded to the ratio approach that he tries to judge reserve adequacy by comparing, internationally and intertemporally, ratios of a country's reserves in any one year to the "net overall balance" in that year.[11]

A closer approach to an acceptable quantitative measure is provided by Heller.[12] He calculates the optimum reserves for a country by relating the cost of a unit of reserves (measured by the long-term rate of interest)

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however, the two formulations can give substantially different results. For example, in the expected value approach there is a zero chance of running out of reserves until the elapse of a number of periods equal to initial reserves divided by the expected value of a one period change. In empirical applications, it is necessary to estimate this expected value and the usual procedure (which is to measure average gains and average losses over recent periods) obviously may involve large sampling errors.

[7] We do not set an upper bound and ask the probability of passing through it before reaching the lower bound (which would turn the problem into a gambler's ruin problem), because although the authorities can be driven out of the game (reserves fall below L) they can never drive out traders by a favorable run of reserve increases. It is also necessary to make T finite, not only because the authorities probably have a finite time horizon, but also because the probability that the particle will reach any finite bound approaches unity as T approaches infinity.

[8] *Op. cit.*, pp. 4–25.

[9] Caves, "International Liquidity: A Home Repair Manual," *Rev. of Econ. and Statis.*, May, 1964.

[10] Weir M. Brown, "The External Liquidity of an Advanced Country," *Princeton Studies in International Finance*, No. 17.

[11] Brown's analysis produces some curious arguments; e.g., the reasoning (p. 10) on the treatment of positive as well as negative balances, and some zany results; e.g., the U.K. series from 1953–63 which runs 84.5, 24.2, 7.6, 27.8, 6.4, 9.1, 2382.5, 405.5, 12.7, 10.7. The conclusion to be drawn is not that U.K. reserve adequacy varied wildly from year to year, but that ratios of current reserves to current balances tell us nothing about the adequacy of current reserves.

[12] H. R. Heller, "Optimal International Reserves," *Econ. J.*, June, 1966, pp. 296–311.

to the expected value of the gain obtainable from the reserves (measured by the loss of national income that would occur if external balance had to be obtained by expenditure damping policies multiplied by the probability of the occurrence of a fluctuation large enough to require the use of the ith unit of reserves). Heller begins by assuming that changes in reserves are not serially correlated, and then calculates the probability that a country will run out of reserves in a single unbroken series of losses, each one equal to the average (trend-removed) change in reserves that the country has actually experienced.[13] He next compares actual reserves with his calculation of each country's optimal reserves to obtain ratios that—assuming the theory on which they are based is valid—have some quantitative significance.

In formulating the problem as one of determining optimal reserves rather than merely calculating the probability of running out of reserves, Heller raises the important question of how to evaluate the advantages of holding reserves that provide a given level of security. Heller's particular approach makes it rational, however, to hold reserves that have a very small probability of being used. For example, if the opportunity cost of reserves is 5 percent and if the marginal propensity to import (m) is 0.1, then the alternative to financing $1.00 of imports through reserves is to lower national income by $10.00 and it would pay to hold reserves which had only one chance in 200 of being used in the current year.[14]

The approach is suggestive, but its implementation poses problems. Because the only alternative to holding reserves that Heller considers is an expenditure-damping policy to cut imports,[15] the potential value of reserves held is a multiple $(1/m)$ of reserves. As a practical matter, countries faced with deficits—particularly those with small m's—will surely consider other alternatives. Selective controls will have a much smaller cost, as will covering current account deficits by raising short-term interest rates to induce temporary capital inflows. If a temporary deficit can be covered by raising the short-term interest rate from 5 to 6 percent, for example, the cost of not holding reserves is simply the extra 1 percent that must be paid on funds borrowed to cover the deficit.[16] This would make the cost of not having $1.00 in reserves $0.06

[13] The probability of running out of reserves is thus $(.5)^{b/c}$, where c is total reserves and b is the average gain or loss in reserves.

[14] Heller calculates only the probability of running out of reserves in a single unbroken sequence of unfavorable steps. What we really need to know in his formulation is the probability of using the marginal dollar this year.

[15] He does mention alternatives briefly on p. 309, but his analytical treatment relies exclusively on the expenditure-damping policy.

[16] If foreigners already hold short-term debt in the deficit country, there will be an additional interest cost on any debt that is refinanced during the period of higher interest rates. Since the rise in interest rates needed to attract a marginal dollar of foreign capital would be minute, the amount of foreign loans being refinanced in the period would have to be vast before the cost of attracting the dollar by this means would exceed the cost of cutting imports by fiscal measures.

rather than $10.00, which would reduce Heller's calculation of the optimum level of reserves by a factor of over 100. This alters ratios of actual reserves to optimal reserves from the range 0.5–2.0 in advanced countries to 5.0–200.0. Of course, our example is crude; but the point is made that the calculation of optimal reserves is extremely sensitive to the set of policy alternatives considered.

It should be remarked, in passing, that if world reserves were "adequate" in Heller's sense and were serving the purpose of financing temporary deficits, some countries would have "too much" reserves and some "too little." We must beware, therefore, of the common conclusion that reserves are wrongly distributed. A not-yet-attempted disequilibrium formulation would be required adequately to handle the problem.

Many variants of the random fluctuations model are possible. Peter B. Clark,[17] for example, sets up a system in which random variations in reserves are partially offset by changes in income, some fraction λ of any discrepancy between actual and desired reserves being eliminated in each period by conscious policy. The protection afforded by a given level of reserves is then calculated as a function of two parameters, the variance of the payments distribution, and the policy parameter λ. Not surprisingly, it can then be shown that the level of protection varies inversely with the variance of payments and directly with the size of λ. The smaller is the policy reaction, the greater is the chance that reserves will be eliminated by an unfavorable run of chance disturbances.

Both Heller and Clark build on the basic assumption that changes in reserves are serially independent. Since we know that trade is subject to seasonal and cyclical patterns, the validity of the independence assumption is questionable.[18] Indeed, Kenen and Yudin have shown that much of the data drawn from a large sample of countries is adequately described by the first-order Markov process:

$$(1) \qquad\qquad \Delta R_t = \lambda \Delta R_{t-1} + \gamma.$$

Starting from this foundation, Archibald and Richmond (in an as yet unpublished paper) have analyzed the security provided by given levels of reserves.[19] Because the random walk problem with serially correlated outcomes has not yet been solved analytically, the authors are forced to fall back on Monte Carlo experiments. They produce many detailed

[17] "Optimum International Reserves and the Speed of Adjustment" (unpublished paper based on M.I.T. doctoral dissertation).
[18] See Peter B. Kenen and Elinor B. Yudin, "The Demand for International Reserves," *Rev. of Econ. and Statis.*, Aug., 1965, pp. 242–50; William Poole, "Speculative Prices as Random Walks," *Southern Econ. J.* Apr., 1967, pp. 468–78.
[19] G. C. Archibald and J. Richmond, "The Theory of Foreign Exchange Reserves: A Probabilistic Approach" (University of Essex, mimeographed discussion paper). We owe our own view of the formalization of the problems in this section largely to the Archibald-Richmond paper.

and interesting quantitative results. Perhaps the most obvious but also the most important from our point of view is that a given level of reserves provides substantially less security when the parameter λ is greater than zero than when reserves are not serially correlated.

This formulation of the problem also makes it possible to handle rationally the question, "Do we need larger reserves as the volume of trade increases?" The usual analysis of this question draws almost exclusively on casual empirical observation to arrive at a resounding answer of "Yes." The question is simply, "Does the distribution of estimated disturbances show a pattern of homoscedasticity or of heteroscedasticity when plotted against the volume of trade?" The answer to this question is by no means clear. Until further evidence is available, therefore, we should view with skepticism the common belief that the level of reserves should expand more or less in line with increases in the volume of trade.

All of this work is interesting and represents a distinct advance on earlier ratio calculations, but how much further it can or should be carried is debatable. There is a clear danger that this aspect of the reserve adequacy problem, because it is amenable to rational formulation, will attract a great deal of effort at the end of which we may delude ourselves into believing that we know something about reserve adequacy in general. However that may be, it appears that two theoretical points, although well known, need to be made as a caution to other workers in the field. The first is that alternative theoretical specifications of the payments process may give very different results for the probability of running out of a given level of reserves yet generate data that give a reasonable statistical fit to equation (1). Unless the difficult task of testing for the empirical balance of evidence between alternative specifications has been carried out with extreme care, we can have little confidence either in the hypothesis that the Markov process is the correct specification or in calculations of reserve adequacy based on the assumption that it is.[20] The second point is that it is impossible to learn anything from such simple equations as (1) about the probability of running out of reserves in a system the underlying structure of which is changing over time, even if the equation produces a fairly high R^2 when fitted to the data. Since low levels of reserves invariably produce speculative movements and strong counter measures on the part of the central authorities, a model of random or systematic fluctuations in current account payments will invariably be a misspecification at just

[20] Assume as an alternative that the underlying structure is sinusoidal. Then if we take observations on Δr fairly close together, they will lie along a narrow loop to which equation (1) will provide a reasonable statistical fit; but the estimated value of the parameter α will depend on the essentially arbitrary choice of the number of observations per cycle—approaching unity as the number of observations increases.

those times when there is a serious chance of running out of reserves, and it will be completely misleading if it is used to predict the probability that a struggle between central authorities and speculators will end in victory for either side.

III. *Unsettled and Insoluble Questions*

As far as we know, all existing quantitative measures of reserve adequacy have been derived on the assumption that reserves are held to meet random and systematic drains associated with varying flows of current account payments and receipts. As indicated in the preceding section, numerous theoretical and statistical difficulties remain to be overcome before we can place much confidence in our ability to assert what reserves are adequate to satisfy even these relatively predictable requirements. The situation becomes much worse if we also take account of nonspeculative and temporary capital transfers and of fundamental disequilibria.

The main difficulty in handling temporary capital movements is that we have virtually no foundation in theory or fact for arriving at estimates of their probable magnitude in alternative circumstances. Short-term capital movements are probably responsive to changes in the international structure of short-term interest rates, but are almost certainly influenced by a host of other and less obvious factors as well. Ask any government how long, for purely domestic reasons, they might want to maintain short-term rates out of line with the international structure, and the extent of our ignorance would surely become obvious. The answer would almost certainly be, "We don't have any idea." And our reply would have to be, "Then we don't have any idea how large your reserves for this purpose should be."

The most serious difficulties of all arise when we turn our attention to the third and fourth reasons for holding reserves. Here we join forces with most other writers on international liquidity and indulge in social conversation. The crux of the problem is that the main justification for holding any but working balances of international reserves is to allow the government time to mobilize its defenses before speculators have occasion to launch an effective attack. It might be possible to arrive at an informed estimate of the time required for effective government action in alternative circumstances; military commanders carry out similar if simpler exercises every day of the week. But even with this information, how could we possibly gauge with any accuracy the conditions in which speculators might decide to attack in force? For the sake of argument, suppose that a country has a perfectly clear idea of the reserves that it needs for normal trading purposes and manages to assemble such reserves together with a substantial margin as a hedge

against the possible emergence of a situation of fundamental disequilibrium. Suppose further that a fundamental disequilibrium actually occurs, but that its existence is not recognized until reserves have fallen to a level where speculators (assumed to be as informed as economists and government officials) are reasonably certain that quiet discussions are taking place in official circles concerning possible changes in domestic economic policy and/or prevailing exchange rates. Regardless of the size of official reserves, what follows will be understandable only as a semipsychological battle of nerves, wit and bluff. Forecasting turning points in the trade cycle is as child's play in comparison with predicting speculative crises—but we have not done well with the former problem either.

The moral is gloomy but plain. We cannot really hope to judge the overall adequacy of reserves in the present situation in which destablizing speculation is encouraged. If we are ever to be in a position to make such judgments, the system itself will have to be changed by working out techniques that will permit governments to demoralize speculators at any desired point in time.[21] Otherwise, no measure of reserve adequacy can have any operational significance, for speculative reserves will always have to be held. A distinctly preferable alternative might be permanently to demoralize central bankers by devising a workable system of flexible rates and simultaneously eliminating gold as a reserve currency. The world might then go about its proper business of providing for the adequacy of more important things than international liquidity and related national status symbols.

[21] It would be difficult to overestimate the ingenuity of economists as a group in devising workable solutions to practical problems and equally difficult to underestimate their ability to sell such solutions to the public. As Yeager has so aptly observed (*op. cit.*, p. 297): "When some economists recommend policies they really expect to work best while others recommend compromises based on their amateur assessments of political acceptability, they create a spurious impression of disagreement among themselves and undermine the authority of their technical knowledge. Unsatisfactory and misinterpreted experience with some compromise system far from gradually educating people . . . is likely to make [desirable changes] even more politically impossible than they are now."

INTERNATIONAL LIQUIDITY: ITS PRESENT RELEVANCE TO THE LESS DEVELOPED COUNTRIES*

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A new departure in the development of international liquidity[1] is likely as a result of the Rio Resolution of the Board of Governors of the International Monetary Fund (IMF). The resolution calls for amendment of the IMF Articles of Agreement to: establish in the IMF a facility for supplementing traditional unconditional reserves—gold, dollars, pounds, francs, etc.—by special drawing rights (SDR's) on the IMF; and reform the rules and practices of the (traditional) IMF.

Accordingly, the relevance of international liquidity to the less developed countries (LDC's), is best discussed under two headings: (1) the participation of the LDC's in the SDR scheme; (2) the possible effect of the SDR scheme on international economic policies, particularly the balance-of-payments adjustment mechanism, with special reference to the LDC's.

I. *The Participation of the LDC's in the SDR Facility*

"Ability" to *Participate.* The ability of the LDC's to participate in a nondiscriminatory scheme to supplement traditional reserves of an unconditional kind was at first questioned by some of the G-10 (group of ten developed countries associated in the General Arrangements to Borrow), among which the idea of artificial reserve supplements was first discussed. Nevertheless, the LDC's achieved complete nondiscrimination in the SDR scheme.

The reason for the doubt mentioned was the belief that the former—as distinct from the developed countries—are irresponsible in the use of reserves; rather than accumulating them, they tend to spend without reconstituting them. The attached table shows that this is not true; in relation to imports, the reserves of the LDC's have since 1951 declined in parallel fashion to those of developed countries. At the end of 1966, they, no less than the general run of LDC's, held the same proportion of reserves—about five months' imports. This is significant, even though

	Reserves as Percentage of Imports		Quotas as Percentage of Reserves
	1951	1966	1966
1. Total developed countries................	68	39	26
2. Total less developed countries............	64	39	46
3. The ten minus the reserve centers†........	30	39	18
4. Other developed countries‡..............	46	39	26
5. Major oil exporters§......................	60	63	24
6. Countries with initial high reserves∮.......	118	21	107
7. Other less developed countries**..........	41	39	42

* Gold and foreign exchange holdings plus reserve positions in IMF at the end of year, related to imports during the year or to quotas at end of year.
† Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden.
‡ Australia, Austria, Denmark, Finland, Greece, Iceland, Ireland, New Zealand, Norway, Portugal, South Africa, Spain, Switzerland, Turkey, Yugoslavia.
§ Iran, Iraq, Kuwait, Libya, Saudi Arabia, Venezuela.
∮ Ceylon, Ghana, India, Pakistan, Sudan, United Arab Republic.
** Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Uruguay, Israel, Jordan, Lebanon, Syrian Arab Republic, Burma, Republic of China, Korea, Malaysia, Philippines, Thailand, Vietnam, Ethiopia, Morocco, Nigeria, Tunisia.
SOURCE: IMF, *International Financial Statistics*, Oct., 1967; see, also, *Annual Report 1966*, p. 13.

the meaning of a given reserve proportion is not exactly the same for LDC's as for developed countries, because of the easier access of the latter to *ad hoc* reserve supplements.

The impression of more "responsible" behavior by developed countries is due exclusively to the increase since 1951 in the reserve proportion held by the eight nonreserve center members of the G-10. Due to the fact that these eight countries emerged from the war with exceptionally low reserve proportions, there is no special significance to this fact, just as there is no special significance to the drawing down of the exceptionally high postwar reserves of a few LDC's (though they went rather too far). (See *IMF, Annual Report*, 1966, p. 14.)

Reserve Accruals to LDC's. Any SDR's created would be allocated in proportion to IMF quotas. Those of the LDC's are, presently, higher in relation to reserves than those of most developed countries, largely because the latter have seldom sought to raise their quotas except at times of general quota increases (see table). The LDC's will therefore presently get a larger proportionate reserve increase out of any given creation of SDR's than the developed countries. It would be foolish to expect any large impact therefrom.

In any case, the initial net impact on world liquidity in a wider sense —and particularly on that of the LDC's—of the SDR scheme is un-

certain. It depends not only on the rate at which SDR's may be created
but on IMF reform. If the latter resulted in the tightening of the rules
of operation of the (traditional) IMF as supplier of conditional liquidity,
it could initially offset in part the effect on liquidity in a wider sense of
any SDR creation.

In fact, it is conceivable that the net effect on liquidity in the wider
sense, particularly of the LDC's—of adoption of the SDR scheme plus
IMF reform may initially be negative—if not absolutely then in relation
to what it might otherwise have been. This is because the SDR scheme,
even before its activation, may discourage further increases in IMF
quotas. At present, none of the dangers mentioned seem likely to be
realized.

Activation is to depend on general liquidity shortage, better payment
equilibrium in the world, and better functioning of the international
adjustment mechanism. The first could as well be defined in terms of the
proportion of world GNP as of number of countries affected. The latter
two are hard to define and possibly contradictory to the first.

Despite these uncertainties and despite the fact that the scheme is
not directly applicable to the prevention of gold drains and the like,
the important thing is that for the first time in history the means may
exist to determine international liquidity deliberately rather than leav-
ing this determination to "nature" (gold), accident (the reserve cur-
rency countries' deficits) plus *ad hoc* arrangements. Nature and accident
may indeed be less irrational than man, but *ad hoc* solutions—and they
are the real alternative to the SDR scheme—are likely to be more ir-
rational than deliberate ones. For the LDC's the scheme is, potentially,
of special importance. They have less ready access to *ad hoc* arrange-
ments to supplement liquidity than developed countries. Moreover, in
general they hold and produce little gold, so that they are not at all
interested in seeing the world liquidity problem solved, if that is the
word, by an increase in the gold price. Nor are they interested in other
so-called "solutions"; e.g., the establishment of new monetary areas
which would unavoidably be discriminatory and involve the contractual
inconvertibility or contractual limitations on convertibility of the re-
spective reserve currencies into gold.

II. *Possible Effects of SDR Scheme on International*
Economic Policies, Particularly on the International
Adjustment Mechanism, with Special Reference
to the LDC's

Lack of a Serviceable Theory of International Liquidity. Good manage-
ment of the SDR facility requires an international monetary theory.
The one available theory, however, is even less precise than domestic

monetary theory. Specifically, one needs to know what amounts or growth rates of international liquidity (given the supply functions of substitutes, like central bank swaps) will bring about certain states of the world economy, in terms of output levels, employment, growth rates, rates of inflation, degrees of autarky, etc., of the various national economies, given the interrelationships between the latter as well as between the targets. One must assume that the IMF will be capable of agreeing on what it considers to be a desirable state of the world economy.

One way of discovering what amounts of liquidity would be adequate to reach the targets would be statistical analysis of past behavior of governments relating liquidity and the various targets.[2] This procedure meets two difficulties. First and basically, the large number of targets or independent variables, all of which will affect the "demand" for liquidity; there may not be enough observations to establish the functional relationships required. Second, the relatively small number of governments whose reactions are relevant for the world, each composed of relatively few important members; any function fitted to the data of any given period may, therefore, be so heavily influenced by the idiosyncrasies of the members of the relevant governments as to be useless as a tool of prediction.

This second difficulty could be overcome. One should be able to find a decision rule for governments which is stable; i.e., independent of its members' idiosyncrasies, taking into account only opportunities and objectives on which there is community-wide and, hence, somewhat enduring agreement. From the decision rules in turn a function could be derived relating liquidity with the desired targets. If one could then assume that governments listened exclusively to their decision theorists, one could make valid predictions. International cross-section studies might also be a means of overcoming the second difficulty.

But the first difficulty mentioned earlier, i.e., the immense number of variables which has to be included in the decision rule, would still, in most practical cases, prevent use of either time series or cross-section studies.

Another possibility is to try to find a reasonably extended recent period where the world economy was in a tolerable state and reproduce for the future the rate of international liquidity growth for that period. It will, however, not be easy to agree on what exactly was

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[2] Attempts made so far seem to have been limited to one-target models or to finding a relationship which will predict reserves but will not indicate what reserves would be optimal; the two things are not identical, particularly considering that reserves can be increased through SDR creation without cost to the world; e.g., H. R. Heller, "Optimal International Reserves," *Econ. J.*, June, 1966, pp. 296–311, and Peter B. Kenen and Elinor B. Yudin, "The Demand for International Reserves," *Rev. of Econ. and Statis.*, Aug., 1965, pp. 242–50.

liquidity growth in any given period; e.g., should one include the reserve centers' net or gross reserves, and so on. Nevertheless, the SDR scheme will undoubtedly (and paradoxically) be applied on this Friedmanian basis of a simple fixed rule, although the scheme does, in principle, permit experimentation.

There is an obvious danger, however, the international financial community being what it is, that lack of a precise guideline as to liquidity "needs" will lead to too much caution in liquidity creation. This danger, for reasons already mentioned and others to be mentioned below, is particularly serious for the LDC's.

A Limited Purpose. One need not leave things entirely in this way. More "traditional" forms of theorizing, while imprecise and at best yielding qualitative rather than quantitative indications and based on vastly simplifying assumptions, might, nevertheless, yield a few useful insights regarding desirable amounts of liquidity. Along these lines one may investigate the way in which various amounts of liquidity make it possible under the assumptions made to achieve various levels of national welfare. One must, of course, make all the heroic assumptions which render welfare statements meaningful. The following discussion also assumes the present system of, generally, pegged rates, simply because this is the assumption underlying the SDR scheme. Moreover, worldwide change in it seems unlikely. What follows is equally applicable to unconditional as well as conditional liquidity; but the world wants the former to grow, not just the latter.

General Considerations. From the point of view of a country faced by a (basic) payments deficit, liquidity is an asset (along with others) the sale of which makes it possible to absorb more than current output (plus long-term capital inflow and aid). The cost of overabsorption is the assets which are sold (plus the [excess] social return on them if they had not been held in liquid form before sale). If the price of assets held in order to permit overabsorption is instantaneously and freely variable in terms of current output or absorption (so that, e.g., the price of gold rises in terms of coffee as gold reserve is sacrificed), each individual in the country in deficit will sacrifice exactly that amount of assets which will permit that amount of overabsorption which will maximize his welfare. But the preceding condition is not generally met where pegged rates prevail; this may mean unintended overabsorption because the economic agent is misled into overestimating the real value of his assets. The reverse—unintended underabsorption—may happen in a surplus country.

Insofar as the financing of balance-of-payments disequilibrium permits intended over- and underabsorption, it raises welfare in both the country in surplus and that in deficit; against this gain must be set the loss from unintended over- and underabsorption.

In addition, however, there may be benefits for both countries from slowing down structural adjustment connected with the elimination of balance-of-payments disequilibrium; it is well to note that such adjustment is generally necessary in both the surplus and the deficit country; and rapid structural adjustment may be attended by more unemployment in either than slower adjustment. The argument here is somewhat similar to that which recommends gradual disinflation rather than a shock treatment. Again there is an offset (as there is also in gradual disinflation); here it is the (extra) structural adjustments which are made necessary (and which must later be undone) by sustaining over- and underabsorption through the financing of a disequilibrium. For, obviously, financing a disequilibrium does not avoid adjustment but merely changes its character.

It is important to recognize that countries in (potential) surplus could not generally escape the burden of adjustment even if countries in deficit were able to eliminate a payments deficit instantaneously. This would help only if the disequilibrium originated in a demand inflation which affected all demands equiproportionately—obviously an absurd idea. Otherwise, e.g., in a demand inflation due to an increase in government expenditures, the neutralization of the demand inflation's impact on the balance of payments would not leave the structure of import demand unchanged and structural adjustment would have to take place in the surplus countries. Moreover, while quick adjustment seems less of a burden to a country in surplus than to one in deficit, this is true only (apart from the, indeed probable, terms of trade loss) because the former can moderate unemployment by gradual inflation without imperiling the exchange rate, a state of affairs which could not exist if adjustment were instantaneous or very rapid.

It follows directly that slowing down the adjustment process by adding to liquidity could be helpful, not only to deficit, but also to surplus countries. Otherwise, increasing liquidity would be of no interest to any particular country, even if it found itself in deficit today, because it must be sure, at some future time, to find itself in surplus.

It should also be clear that not only so-called "temporary" but also so-called "fundamental" disequilibrium can reasonably be financed for a time, although it is not at all clear that temporary disequilibrium should be wholly financed, since this would not avoid either unintended over- and underabsorption (as might seem at first sight), nor structural adjustments. While the distinction between the two kinds of equilibrium is arbitrary, the difficulty of diagnosis is probably overestimated. But an event leading to a fundamental disequilibrium (e.g., a nontransitory change in the terms of trade) may make it perfectly rational to under- or overabsorb for a period and to want to slow down the process of adjustment.

Nevertheless, the argument for financing generally becomes much stronger, both on the grounds of intended over- and underabsorption and on the grounds of slowing down structural readjustment, where a temporary disequilibrium is concerned. First, not to finance might mean imposing a fluctuation on the rate of absorption in excess of the one which economic agents might desire. Second, less structural adjustment is likely to be involved.

The insights looked for here are not of the kind which would lead one to any direct conclusion regarding the present adequacy of liquidity. But they do seem to suggest that the usual theoretical case for financing of disequilibrium and thus for liquidity "needs" may be underestimated.

Beyond "improving" in the sense of making less painful rather than more quick the balance-of-payments adjustment process, the provision of adequate liquidity is likely to lead to a generally less restrictive international economic policy and, hence, to more rapid growth in the world as a whole. Apart from genuine infant industry protection such a policy is, or should be, of special interest to the LDC's—both for themselves and for their trading partners—because of its dynamic advantages in easing the structural adaptation involved in their growth process (rather than because of its static advantages in improving allocation once for all). Each dollar of additional growth to them is naturally of much more importance than to the industrialized countries.

The LDC's. Does the present analysis suggest different reserve needs for LDC's than for developed countries? The only systematic difference between the two groups is the definitional one of the relative poverty of the former. This alone, however, establishes no presumption regarding relative liquidity needs.

Poverty generally means primary products exports. Contrary to widespread belief held previously, countries exporting primary products have not in the postwar period systematically and significantly suffered from larger instability in exchange earnings than industrial countries. Nor is any given degree of exchange earnings instability more important to the former than to industrial countries, because LDC's do not on average trade more in proportion to GNP than industrial countries. Moreover, the primary producing countries have not in the postwar period suffered from greater instability in GNP or in internal price levels than industrialized countries.

Even without further research, which is badly needed, one must not exaggerate the importance of these findings. The instability in the export earnings of LDC's as a group exceeds—because of the situation of some LDC's—that of developed countries as a group by no less than 45 percent (although instability seems to be associated not with income

level or export structure but rather with the particular exports which certain countries mainly engage in). Also, instability of export earnings has some—although not a strong—correlation with growth (negative) and with rates of inflation (positive).[3]

It has also been claimed that LDC's are more "rigid"—i.e., have lower elasticities of supply and demand—than developed countries. The contrary claim has rarely been asserted. Insofar as the former claim is correct, it creates additional arguments for greater reserve needs of LDC's.

Whatever one may believe on this matter, there remains, at the very least on the basis of the incidence of larger temporary disequilibria, a case for special liquidity needs for LDC's as a group as compared to developed countries as a group and for some LDC's individually. At the very least, there is no support for the view that they need less liquidity than developed countries. This has, nevertheless, been suggested by those who consider that LDC's have special reasons (over and above any general ones) to adopt "floating" rather than fixed rates.

The arguments for this position—instability of export earnings and endemic inflation—are not convincing. If instability of export earnings in LDC's is not systematically larger than in developed countries, then LDC's in general have no special need of floating rates to promote a quick distribution of the resulting burdens and benefits away from the export to the various other sectors of the economy, though some LDC's have. On the other hand, LDC's are not systematically subject to significantly more inflation than developed countries. Thus, in March, 1967, of thirty-five LDC's for which figures were readily available twenty countries, or 57 percent, had in the twelve preceding months had annual rates of inflation of less than 5 percent; of twenty-two developed countries similarly listed, the percentage of countries with less than 5 percent annual inflation was not much larger; viz., 68 percent.[4]

Some Related Considerations. Other uses to which the SDR facility could be put have been suggested, beside easing payments adjustment and preventing restrictive policies.

One is straight development assistance. Another is so-called "supplementary" finance, a sort of variant of compensatory finance. Still another is its use to promote regional economic integration of LDC's through regional pools of SDR allocations. But these are political problems. Economists have no particular insights to offer on these uses since it is not claimed that they would be technically impracticable.

[3] See Alasdair I. MacBean, *Export Instability and Economic Development* (Harvard Univ. Press, 1966), pp. 39, 56, 58, 62, 78, 116–19, 123.
[4] *International Financial Statistics*, Nov., 1967, p. 33.

INTERNATIONAL LIQUIDITY:
THE CASE OF THE UNITED KINGDOM

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One must distinguish at least three different views on international liquidity in the United Kingdom. Or rather, one must discuss Keynes and two other views.

Keynes, of course, was concerned with international monetary questions on and off for most of his life, and he changed his mind from time to time, largely in response to events. However, there are two main points which appear in his writings with reasonable consistency. First, countries should not rely exclusively on deflation to correct balance-of-payments deficits when a significant fall in their external cost level is required. This is because costs and prices are not sufficiently flexible downwards to enable serious unemployment to be avoided in such a situation. In Harry Johnson's terminology, countries must be prepared to use specific expenditure-switching policies and not rely on the indirect effects of expenditure-reducing policy to lower money costs. Keynes's preference among expenditure-switching measures was clearly for a degree of exchange rate flexibility; but in appropriate circumstances (when employment effects are important relative to resource allocation effects) he accepted import restrictions as an alternative. Second, Keynes did not (except perhaps for a time in the 1920's) favor freely fluctuating exchange rates; and he emphasised, particularly during the Bretton Woods period, that if exchange rate changes are to be relatively rare and if world trade and payments are to be relatively free, there must be fairly generous provision of liquidity for deficit countries to spend while they diagnose and take steps to correct the situation. In short, Keynes believed in rather generous "liquidity to spend" combined with a firm adjustment mechanism, including a change in parities, at the end of the day. This, of course, is the view of many economists today and is the conclusion which Professor Cooper reaches in his paper.

An older and less analytical tradition of British thinking on external reserves is represented by Bagehot's *Lombard Street*, published nearly a hundred years ago. Bagehot approaches the problem from a banking rather than a balance-of-payments standpoint. This means two things. First, the adequacy of reserves is considered mainly in relation to long- and short-term capital movements, and hence to the country's external liabilities and assets, rather than in relation to the volume of trade and to possible disturbances on current account. There is no discussion of

the current account adjustment process. Second, borrowing both on official and (under the stimulus of monetary policy) on private account is regarded as a close substitute for the use of reserves. Indeed, the essence of reserve assets in a developed monetary system is that they should never be fully used but should be kept above a certain minimum level (Bagehot speaks of "the apprehension minimum") in order to promote confidence in the system and enable it to operate efficiently on the basis of credit.

This approach is similar to "Mrs. Machlup's Wardrobe Theory" in that it takes a "balance-sheet view" of reserves. The difference between the two is that for Bagehot large reserves promote market confidence and make the system work smoothly, whereas for Professor Machlup (and also other writers such as Marcus Fleming of the IMF) large or increasing reserves promote desirable policies on the part of the authorities—freer trade and payments and no overhasty deflation. Perhaps the difference is only that Bagehot was writing in the age of laissez faire, whereas the others are post-Keynesian.

The third view to be considered is the British official attitude in the postwar period. This has, at first sight, affinities with Bagehot or with Mrs. Machlup. The U.K. authorities have been concerned about the level of U.K. reserves mainly in relation to the sterling balances, not in relation to the British economy's propensity to get into deficit on current and long-term capital account; deficits must be temporary and can be financed perfectly well on credit. The difference is, however, that the British authorities, while professedly anxious to obtain larger reserves, have given this objective rather low priority on their scale of preference. The relaxation of exchange controls, the abolition of institutional clearing arrangements such as the European Payments Union, and the promotion of capital exports have ranked way ahead of reserve accumulation—partly no doubt because the authorities were hoping that a lot of liquid funds would be placed permanently in London once sterling was permitted to resume its "traditional" role in the world economy. The restoration of this role was the overriding aim of Britain's international monetary policy in the 1950's and early 1960's, just as the status of the dollar is the main preoccupation of the U.S. authorities today.

The events of 1964–67 have forced a change of view so far as sterling is concerned. The pound is no longer expected to rival the dollar as a trading currency; and even the Bank of England has ceased to claim that overseas sterling-area central banks hold sterling balances from choice (rather than because Britain is unable to finance their liquidation). The next few years may well see concrete proposals to dismantle the sterling reserve system; e.g., by enabling the OSA countries to hold

"sterling" reserves through the IMF instead of in London directly. As regards British reserves, however, it is a fair bet that even today the U.K. authorities are aiming at external surpluses sufficient only to repay the IMF drawings and other credit and not in order to build up a larger holding of gold and dollars thereafter. In other words, while the British would quite like to have larger reserves in the kitty, they are not prepared to sacrifice anything in order to "earn" them, and therefore a low and stationary level of reserves has little effect on their financial policies. What they would welcome is a rise in the gold price, special drawing rights, or any other scheme to create reserves painlessly. You might say that in London Mrs. Machlup is delighted to wear an evening gown if someone presents her with it; but otherwise she's happy in a miniskirt.

In this regard Britain is rather untypical among developed, or at least European, countries. Professor Cooper and Professors Clower and Lipsey are inclined to dismiss the "balance-sheet view" of reserves as irrational or pointless, at any rate when it is used to justify expansion of reserves. Why should central bankers want to build up liquidity that they have no intention of ever using? The trouble with this is that a demand for reserves to finance deficits can also be regarded as irrational. An ideally rational world would surely rely on exchange rate flexibility and have no official reserves at all. Clower and Lipsey do their best to be consistent on this point. They decline to discuss not merely the demand for "liquidity to hold" (on the grounds of irrationality) but also the adequacy of "liquidity to spend" in relation to fundamental disequilibria (on the grounds that this is largely "social conversation" and yields no precise quantitative criteria). Instead, they put their money on simple statistical models, which tell us what size reserves might be necessary to cope with "systematic and random fluctuation in current-account receipts and payments," given that the country's external balance is in fundamental equilibrium. This reminds me of the story about the comedian who dropped some coins one night in a dark corner of the street and then insisted on looking for them under the nearest lamp because that's where the light happened to be.

To be quite fair to the authors, the assumptions of these simplified models (random disturbances with basic equilibrium) are relevant in certain special cases. The IMF arrangements for compensatory financing of export fluctuations are based on an approach of this kind, and one should mention the econometric work done in the Fund in connection with the scheme (Fleming et al., IMF Staff Papers, 1963). However, a general analysis of reserve adequacy that is relevant to real-world problems cannot avoid looking into the darker corners of the adjustment process. In particular, it is not sufficient to discuss the problem in

terms of a single country's policies. A multicountry approach is needed, along the lines of Professor Cooper's paper, in which the impact of one country's behavior on other countries is specifically considered.

The multicountry approach, however, also brings out the case for a steady growth of international reserve assets, even in a world where there are (at least for the time being) no major disequilibria to be financed. The point is that some growth in reserve assets seems to be necessary for the equilibrium of the world system, because most countries, especially developed countries, regard regular increases in their reserves as normal and desirable. There are two reasons for this. One is that countries like to build up reserves against the possibility of larger deficits in the future. IMF quotas and other credit lines do not give the same sense of security as owned reserves; there is always the risk, however slight, that they will not be available when required, and drawings on them are subject to repayment terms set by the creditor. The other reason is that management of the economy is technically and politically easier if the need for sharp deflationary adjustments can be avoided—so it seems preferable to play safe by aiming at small surpluses. This side of the argument was advanced some years ago by Poul Høst-Madsen of the IMF and has since been stated with greater force by Milton Gilbert of the BIS. Of course, if techniques of economic management were perfect and if there were no uncertainty in the world, there would be no need to worry about blundering into uncomfortably large deficit. In practice these conditions are not satisfied. Countries therefore try to keep on the right side of equilibrium and to build up their external reserves gradually as their GNP expands. Unless they can do this on a reasonable scale without forcing any one of their number to lose reserves or move into deficit involuntarily, there will always be disequilibrium somewhere in the system. In equilibrium it is not deficits but normal surpluses that need financing. Thus there is a case for regular increases in reserve assets or "liquidity to hold," which is distinct from any argument about "liquidity to spend" and the responsibilities of deficit and surplus countries in correcting particular payments disequilibria.

INTERNATIONAL LIQUIDITY: THE CASE OF THE COMMON MARKET

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The difficulty of presenting the case of the Common Market in this field lies in the fact that there is some diversity of opinions and of policies among the Six. It is, however, possible to find common features or orientations: the same insistence on the necessity of a rapid adjustment of the U.S. balance of payments, the same feeling that we must avoid the perpetuation of unsound international financing, the same desire to look at the creation of the new special drawing rights as a means to keep enough liquidities in the world when the U.S. deficit has been suppressed, and not as a new way of financing this deficit.

In the field of international monetary problems, we will try to answer three main questions: How has an EEC case emerged on international monetary issues? What are the common concerns of EEC countries? What kind of solutions are viewed by these countries?

I. *The Emergence of the EEC Case*

The nearly complete abolition of all tariffs and nontariff barriers between the Six, the process of unification of the main agricultural prices and the nearly complete freedom of movements of capital are the most important factors explaining the emergence of a new economic unit in the world. These countries have experienced now the fact that they are tied by a strong interdependence, and that inflationary and deflationary pressures are rapidly transmitted across the borders. They must give mutual help to one another (Article 108 of the Rome Treaty) and their exchange rates are also strongly interdependent.

There has been a progressive coordination of external monetary policies, and the Monetary Committee of the EEC is playing a growing role in all the important international issues.

It has thus prepared the decisions taken by the six ministers of finance where a common attitude was adopted on the special drawing rights and the parallel reforms of the IMF.

The balance-of-payments statistics (1959–66) show on the whole that common features appeared between the Six, the only exception being the case of Italy in 1963: the surpluses of goods and services balances were higher than the net outflows of capital and explain the continuous increase of reserves. France and Germany made advance reimbursements of external debt to the U.S. The increase in reserves

was specially remarkable for France—whose reserves were very low in 1958—but one must notice that the French reserves are now equivalent to six months of imports—a ratio similar to the U.S.[1]

The Netherlands Central Bank has published very interesting tables which try to show the balance of payments of EEC as a whole for the years 1959 to 1966, compared with the other important economic parts of the world.[2] It is clear that, with the exception of the U.K., all major industrial countries have registered a surplus in their balance of trade— which can be explained by the aid given to developing countries. The major differences between industrialized countries, as far as the basic balance is concerned, appear in the long-term private capital movements: in nine years the U.S. shows a cumulative net export of $22.3 billion and the EEC countries a cumulative net import of $5.2 billion. These movements have contributed to the deficit of the basic balance of the U.S. which, by coincidence, is on average of the same size ($1.7 billion a year) as the surplus of the EEC basic balance. This deficit was settled only partially in gold; but the U.S. found imaginative ways able to convince the European countries to increase their reserves in dollars, contributing thus to the maintenance of an outflow of U.S. private capital which would not have been allowed by the surplus registered on current accounts. Hence the feeling currently expressed that Europe was asked to finance a deficit created by the wave of U.S. companies investing in Europe or buying European enterprises. Feelings are perhaps too simple, but they are also facts.

The common concern that such a situation has brought about among EEC countries is perfectly reflected in the annual reports of the EEC Monetary Committee which state:

Direct American investment has unquestionably contributed to economic growth in Europe, especially where accompanied by the transfer of advanced industrial technique. But the flows of capital in all forms to the EEC has none the less become excessive, jeopardizing, at least for a time, the equilibrium of international payments and hampering the European countries in their fight against inflation. (Eighth report, April 15, 1966.)

. . . .

For the United States, as for the EEC, the surpluses recorded on the current account have, for the past ten years, approximately represented the sums needed to cover the international responsibilities of the countries concerned, notably the aid they must give to the developing countries.

The imbalances arise mainly from movements of capital. A broad stream of American investment has been flowing into the EEC countries and has offset the exports of capital from these countries to non-member countries, especially the developing countries. Action should be taken to correct the existing imbalance in payments between the United States and the Community. (Ninth report, March 1, 1967.)

It is therefore useful to analyze the components of this main EEC

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[1] This example may correct the false impression one may get by the dramatic comparison given in "Maintaining the Strength of the U.S. Dollar in a Strong Free World Economy" (U. S. Treasury, Jan., 1968), pp. 120 and 121. All economists know that a table (like Table 24) based on one arbitrary reference year and showing only changes is misleading.

[2] De Nederlandsche Bank N.V., *Annual Reports*, 1962 to 1966.

concern, the desequilibrium of international movements of capital, before expressing the EEC views on the solutions to be brought to the present imbalance of the international monetary system as a whole.

II. *The Desequilibrium of International Capital Movements*

The present inadaptation appears largely due to the fact that the recent evolution of capital markets in the U.S. and in Europe has not been reflected in international capital transactions. Messrs. Deprez, Salant, and Kindleberger were right to show the U.S. playing a useful role of world banker, receiving short-term deposits and making long-term investments or loans. But the banker has to appreciate the changing situations of his customers, and if he continues to make investments and loans when the deposits are not increasing sufficiently, he ordinarily runs into difficulties, which begin generally by some loss of "confidence." If this banker asks the depositors to refrain from drawing on their accounts, then he is always increasing his own troubles.

It is true that ten years ago the European capital markets were small and completely separated. The rates of interest were largely independent. The capacity of the capital markets was limited, because of a lack of confidence in the stability of the European currencies. But we have seen a reestablishment of monetary markets in Europe, in connection with the eurodollar mechanisms, and an increase and a growing interconnection between the national long-term capital markets due to the elimination of restrictions of exchange and the progressive liberalization.[3]

At the same time the functioning of the capital market in the U.S. and notably its ability to provide an adequate level of long-term funds abroad has been impaired. The increase of internal demand of long-term funds by the public sector and, in the most recent years, the growth of demand of long-term funds by private corporations have created some disequilibrium of the U.S. capital market. The additional liquidities provided by the Federal Reserve System in order to cope with this disequilibrium—and which were the only way to continue long-term loans abroad even in that period—were in fact adding to the prevalent inflationary pressures.

This new strength of the European capital market and this difficulty of the U.S. capital market to provide long-term funds without detrimental effects has not been reflected, in international transactions, by a reduction of the outflow of long-term capital from the U.S. From $1.4 billion in 1959 this outflow has grown to more than $3 billion in 1965 and 1966. The measures taken by the U.S. administration did not reach

[3] See *Le développement d'un marché européen des capitaux (Rapport*, EEC, Bruxelles, Nov., 1966).

their objectives. One reason is that the interest equalization tax was applicable only to investments in shares lower than 10 percent of the total capital, the other reason being the excessively high targets of the voluntary program; i.e., the total target for 1965–66 (two years) was 90 percent of 1962–64 (three years' total, which meant an average increase of 35 percent between the two periods). The investments of European affiliates of U.S. corporations in 1966 reached an estimated total of $6.4 billion financed through: undistributed earnings and depreciation, $2.1 billion; European financing, $3 billion; finance from the U.S., $1.3 billion.

At the same time the net short-term foreign investments in the U.S. were declining. From 1961 to 1965 there was some increase of private deposits in U.S. banks (+$5.3), but a large development of short-term bank lending abroad (−$3.6) and a growing deficit (−$4.2) of short-term nonbank capital (including "errors and omissions").

All these factors explain that the U.S. had a deficit in the balance of payments of $21.4 billion on an overall basis for 1959–66 to be compared with a surplus of $12.9 billion for the EEC countries. This deficit has been settled in gold only to the extent of $7.4 billion and has therefore increased the accumulation of foreign official short-term dollar assets, which are creating new risks for the future.

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Assets		Short-term Liabilities	
Gold.............	13.1*	Central banks.............	14.1 (Europe=8.3)
Foreign exchange.	0.7	International organizations..	1.9
		Other banks and foreigners...	14.1
	13.8		30.1

* Including $1 billion belonging to the IMF.

This situation, as the Europeans see it, cannot continue a long time in the same way. The strength of the dollar is not attacked by foreigners, but needs a change of policy just because the facts do not allow a perpetuation of the same trend.

III. *The Conditions of a Solution to the Present Imbalances*

The concern of the EEC countries about the U.S. balance-of-payments deficit results from the fact that it is creating inflationary pressures in the world and especially in Europe, and that European governments have to adopt severe financial and credit policies to compensate these pressures. They feel that the U.S. did not help them sufficiently by correcting the deficit through drastic internal financial measures. The

eternal problem is to find out who must take the burden of the adjustment: the deficit or the surplus countries. It is clear that the problem is not seen from the same point of view from both sides of the Atlantic Ocean.

Two sets of solutions are always possible to bring the necessary adjustments. First, the global adjustment process; i.e., the chain of corrective changes in the domestic economy of the deficit countries, which succeed in halting the inflationary movements created by the budget deficit or the credit increases and therefore bring back external equilibrium. Second, the direct measures of control of some external transactions which are thought to be the main cause of the deficit; the difficulty of this second method being the perverse feedback effects of all direct controls—for example, the reduction of exports when the aid is cut or the flight of private capital afraid of a move toward a complete control over foreign exchange.

According to the different views of the six countries of EEC, the accent has been put rather on the first approach or on the second one. But the present situation clearly shows that rapid action in both directions is now necessary. The direct measures of control are useful because they may have—if their implementation is correct and rapid—an immediate effect on the flow of funds. The adverse feed-back effects take normally some time to develop and that time lag can be used to restore confidence. There is always some confidence created—at least at the beginning—when a government is acting, because it shows that the problem is considered as serious and is not left to hazards. The control of direct private investments abroad is normally one of the first steps in that direction and is now advocated by many Europeans as a stop-gap measure as long as the other measures have not begun to produce some impact. From the EEC point of view, the restoration of equilibrium implies decisive actions from the deficit countries. The excess of global demand has to be eliminated by a choice between private consumption, public consumption at home and abroad, and private investments, also at home and abroad. These choices have to be made by the responsible authorities themselves, and to be implemented through adequate fiscal and credit policies. All the programs launched by the U.S. administration since five years in order to resolve the balance-of-payments problems failed to reach their objectives—perhaps because they were only piecemeal programs and not comprehensive ones. This has given the impression that the seriousness of the problems is not generally clearly viewed and that the public opinion and the parliamentary opinion are not in the mood to accept any restraint. It is not possible to ask Europe to renew with inflation in order to solve the U.S. difficulties; and it would not be in the interest of EEC countries

to ask for a strong deflationary economic policy in the U.S. They are just waiting for normal corrective measures. If the adjustment cannot be made, then it is understandable that the whole system of the international financial organization will be in question, and that would bring new waves of speculation on the price of gold.

This system and the gold exchange standard have played a very useful role in the years of European recovery, for it has been the way through which the world has benefited of the capacity of the U.S. financial market to provide long-term funds. Its natural limits were clearly defined by the limits up to which the foreigners, individuals, commercial or central banks were ready to accept short-term claims in the U.S. A great range of artificial measures have been imagined to go beyond these natural limits and to allow the perpetuation of the external deficits of the United States through the permanent increase of external liabilities.

When a country has during a short period difficulties financing external deficit, the cooperation of other countries is a normal way of helping to wait for a better time. When there is no more any hope to see a change, then the usefulness of such cooperation is doubtful. That was clearly the position the U.S. administration took ten years ago towards the French deficit. There was no other issue left open as to correct this deficit, otherwise it would not have been possible to continue to finance the necessary imports. It is not always easy to find out if the problem is a short-term or a long-term one. The U.S. deficit has been financed in the last years as if it were a temporary problem, but the cooperation thus given has exceeded the normal duration and volume.

Therefore the creation of the new special drawing rights scheme is not viewed by Europe as a new means of financing the deficit of the reserve currencies countries; and this explains why the EEC have asked for a blocking vote on that question. When the creation of additional reserves through the dollar deficit will be suppressed, then a shortage of international liquidity may appear. That was not the case in the recent years. If and when that happens, then supplementary credit facilities by the IMF could be useful, and it is in that spirit that the London agreement was accepted.

A new postponement of the choices will undoubtedly bring about disruption of the present framework of the international monetary system and, at least temporarily, a separation of the world in several areas. But it is the firm hope and wish of all EEC countries that restoration of the U.S. balance of payments will provide in an orderly manner the reestablishment of normal links between financial and monetary markets in the U.S. and in Europe.

APPENDIX
TABLE 1
BALANCE OF PAYMENTS OF THE EEC
(Billions U.S. Dollars)

	1959	1960	1961	1962	1963	1964	1965	1966	Total	Annual Average
1. Balance of trade	2.0	1.6	2.0	0.9	-0.2	0.6	1.8	2.4	11.1	1.4
2. Invisibles	1.4	1.7	1.2	0.7	0.8	0.5	0.5	0.5	7.3	0.9
3. Current account	3.3	3.2	3.2	1.6	0.6	1.1	2.3	2.8	18.1	2.3
4. Unilateral transfers and regular long-term government capital	-0.9	-0.9	-1.1	-1.3	-1.3	-1.2	-1.4	-1.6	-9.7	-1.2
5. Long-term private capital	0.5	0.6	0.7	0.5	0.9	1.2	0.9	-0.3	5.2	+0.6
6. Basic balance (items 3 to 5)	3.0	2.9	2.9	0.8	0.1	1.2	1.7	0.9	13.5	1.7
7. Special government transactions	-0.4	—	-1.0	-1.3	-0.4	—	-0.3	-0.3	-3.7	-0.4
8. Short-term nonbank capital										
9. Short-term bank lending	-0.5	+0.2	-0.2	0.8	0.4	0.9	0.8	0.8	3.2	0.4
10. Overall balance (items 6 to 9)	2.1	3.1	1.7	0.3	0.1	2.0	2.2	1.4	12.9	1.6
11. Foreign exchange transactions of banks	-0.4	0.3	0.4	0.4	1.2	-0.2	-0.8	-0.3	0.6	0.1
12. Increase (+) in net official reserves (10+11)	1.7	3.4	2.1	0.7	1.3	1.8	1.4	1.1	13.5	1.7
Comprising										
12a. Gold	1.1	1.5	1.4	0.6	0.9	0.9	1.6	0.4	8.4	
12b. Foreign exchange assets	+0.4	+1.8	-0.2	+0.3	0.4	0.2	-1.3	—	1.7	
12c. Foreign exchange liabilities										
12d. Reserve position in IMF	+0.5	+0.3	+0.9	-0.2	-0.1	0.1	0.1	0.7	3.9	
12e. Liabilities to IMF					0.1	0.6	1.0	—		
12f. EPU position	-0.3	-0.2	—	—	—	—	—	—	-0.5	

TABLE 2

BALANCE OF PAYMENTS OF THE UNITED STATES

(Billions U.S. Dollars)

	1959	1960	1961	1962	1963	1964	1965	1966	Total	Annual Average
1. Balance of trade..............	1.0	4.7	5.4	4.4	5.1	6.7	4.8	3.7	35.8	4.5
2. Invisibles....................	−0.4	−0.7	0.2	0.6	0.8	1.8	2.2	1.6	6.1	0.8
3. Current account.............	0.6	4.1	5.6	5.1	5.9	8.5	7.0	5.3	42.1	5.3
4. Unilateral transfers and regular long-term government capital...	−3.2	−3.5	−4.1	−4.3	−4.7	−4.3	−4.7	−4.9	−33.7	−4.2
5. Long-term private capital........	−1.6	−2.1	−2.2	−2.6	−3.3	−4.0	−4.1	−2.4	−22.3	−2.8
6. Basic balance (items 3 to 5)......	−4.3	−1.5	−0.7	−1.8	−2.1	0.2	−1.8	−2.0	−14.0	−1.7
7. Special government transactions.	0.4	—	0.7	1.2	0.3	−0.3	−0.3	0.4	2.4	0.3
8. Short-term nonbank capital......	0.3	−2.6	−1.2	−1.4	−0.1	−1.3	0.3	−0.5	−10.1	−0.7*
9. Short-term bank lending.........			−1.0	−0.4	−0.7	−1.6	0.3	−0.2		−0.6*
10. Overall balance (items 6 to 9)...	−3.6	−4.0	−2.2	−2.4	−2.6	−2.9	−1.5	−2.3	−21.5	−2.7
11. Foreign exchange transactions of banks.................	1.1	0.1	0.5	—	0.6	1.6	0.1	2.5	6.5	0.8
12. Increase (+) in net official reserves (10+11).............	−2.5	−3.9	−1.7	−2.4	−2.0	−1.4	−1.4	0.2	−14.8	−1.9
Comprising: 12a. Gold............	−1.1	−1.7	−0.9	−0.9	−0.5	−0.1	−1.4	−0.8	−7.4	
12b. Foreign exchange assets.					0.1	0.2	0.3	0.5		
12c. Foreign exchange liabilities............	−1.4	−1.8	−0.9	−0.9	−1.6	−1.2	−0.1	1.0	−5.8	
12d. Reserve position in IMF.						−0.3	−0.2	−0.3	−1.6	
12e. Liabilities to IMF........	—	−0.4	+0.1	−0.6	—					

TABLE 3

BALANCE OF PAYMENTS OF THE UNITED KINGDOM
(Billions U.S. Dollars)

	1959	1960	1961	1962	1963	1964	1965	1966	Total	Annual Average
1. Balance of trade	−0.3	−1.1	−0.4	−0.3	−0.2	−1.5	−0.8	−0.4	−5.0	−0.6
2. Invisibles	0.8	0.5	0.6	0.8	0.8	0.8	0.9	0.7	5.9	0.7
3. Current account	0.5	−0.6	0.2	0.5	0.6	−0.7	0.1	0.3	0.9	0.1
4. Unilateral transfers and regular long-term government capital	−0.4	−0.4	−0.5	−0.5	−0.6	−0.7	−0.6	−0.7	−4.4	−0.5
5. Long-term private capital	−0.4	0.1	−0.1	—	−0.2	−0.7	−0.4	−0.1	−1.8	−0.2
6. Basic balance (items 3 to 5)	−0.2	−0.8	−0.5	—	−0.1	−2.1	−0.9	−0.5	−5.1	−0.6
7. Special government transactions	—	—	0.2	—	—	0.4	0.6	0.1	1.3	0.1
8. Short-term nonbank capital	−0.1	1.1	—	0.7	−0.4	0.2	0.5	−0.2	1.8	+0.2
9. Short-term bank lending	−0.1	1.1	—	0.7	−0.3	−0.4	−0.1	−0.2	−1.0	−0.1
10. Overall balance (items 6 to 9)	−0.3	0.3	−0.3	0.6	−0.8	−1.9	0.1	−0.8	−3.1	−0.4
11. Foreign exchange transactions of banks	0.2	0.6	−0.8	0.2	0.4	0.5	—	−0.5	0.6	0.1
12. Increase (+) in net official reserves (10+11)	−0.1	0.9	−1.1	+0.8	−0.4	−1.4	0.1	−1.3	−2.5	−0.3
Comprising:										
12a. Gold	−0.3	+0.3	−0.5	+0.3	−0.1	−0.3	0.1	0.3	0.8	
12b. Foreign exchange assets					−0.1	0.4	1.1	−0.3	−0.3	
12c. Foreign exchange liabilities	−0.3	+0.1	+0.5	−0.6	−0.2	−0.5	0.3	−0.7		
12d. Reserve position in IMF	+0.4	+0.4	−1.1	+1.1	—	−0.5	−1.4	—	−1.6	
12e. Liabilities to IMF					—	−0.5	—	—		
12g. EPU position	+0.1	+0.1	—	—	—	—	—	—	+0.2	

TABLE 4
SUMMARY OF BALANCE OF PAYMENTS
(Billions U.S. Dollars)

	Total 1959-66						Annual Average 1959-66					
	U.S.A.	U.K.	EEC	Other Ten	Other Countries and Adjustments	Total	U.S.A.	U.K.	EEC	Other Ten	Other Countries and Adjustments	Total
1. Balance of trade.	35.8	−5.0	11.1	2.7	−40.8	+3.8	4.5	−0.6	1.4	0.3	−5.1	0.5
2. Invisibles.	6.1	5.9	7.3	− 9.9	− 9.1		0.8	0.7	0.9	−1.4	−1.1	
3. Current account.	42.1	0.9	18.1	− 7.3	−49.9		5.3	0.1	2.3	−1.0	−6.2	
4. Unilateral transfers and regular long-term government capital.	−33.7	4.4	− 9.7	− 1.8	49.2		−4.2	−0.5	−1.2	−0.2	6.1	
5. Long-term private capital.	−22.3	−1.8	5.2	7.0	11.9		−2.8	−0.2	0.6	+0.9	1.5	
6. Basic balance (items 3 to 5).	−14.0	−5.1	13.5	− 2.1	11.1	+0.0	−1.7	−0.6	1.7	−0.3	1.4	0.0
7. Special government transactions.	2.4	1.3	− 3.7	−0.1	0.2		+0.3	0.1	−0.4	—	—	
8. Short-term non-bank capital.	10.1	−2.8	3.2	5.0			−0.7*	0.2	0.4	0.6		
9. Short-term bank lending.							−0.6*	−0.1		—		
10. Overall balance (items 6 to 9).	−21.5	−3.1	12.9	2.7	−6.6		−2.7	−0.4	1.6	0.3	−0.9	
11. Foreign exchange transactions of banks.	6.5	0.6	0.6	0.4			0.8	0.1	0.1	0.1		
12. Increase (+) in net official reserves (10+11).	−14.8	−2.5	13.5	3.1	4.7	+3.9	−1.9	−0.3	1.7	0.4	0.6	+0.5

TABLE 5

VARIATIONS OF OFFICIAL NET RESERVES
(Billions U.S. Dollars)

		U.S.	U.K.	EEC	Other Ten	Other Countries and Adjustments	Total
12a.	Gold.............	−7.4	−0.8	8.4	1.3	0.4*	1.9*
12b.	Foreign exchange..	−5.8	−0.3	1.7	1.2	3.2	—
12c.	Assets and liabilities						
12d.	IMF position......	−1.6	−1.6	3.9	0.7	0.7	2.1
12e.							
12f.	EPU position......		0.2	−0.5	—	0.4	—
	12 Total†...........	−14.8	−2.5	+13.5	3.1	4.7	3.9

* Include special gold transactions of IMF and BIS. The increase in central banks' gold reserves appears in the two following tables:

−Increase (+) of monetary gold	3.7	Increase of gold assets (Table 8)	1.9
+BIS/EF gold transactions	0.6	+BIS/EF gold transactions	0.6
	——	+IMF gold investments	0.6
	4.3		——
		Increase in central banks'	3.1
−IMF regular gold transactions	−2.1	gold reserves (derived from two preceding tables)	
	——		
	2.2		
+IMF special gold transactions	0.8		
	——		
Increase in central banks' gold reserves (source IMF/BIS reports)	3.0		

† Net reserves. The variations of official gross reserves have been the following ones:

VARIATIONS

	12/31/59	1959-66	12/31/66
Gold..........................	38	3.0	40.9
Foreign exchange................	17	7.4	24.4
IMF reserve position............	2.6	3.8	6.3
	57.6	14.2	71.6

Tables 1 to 5

Methodological Notes

SOURCE: De Nederlandsche Bank N.V., annual reports, 1962 to 1966. As a result of roundings the totals do not always agree. Figures calculated by the Netherlands Bank on the basis of data derived from the statistics of the countries concerned and the International Monetary Fund; in various cases the figures have been regrouped. Data for 1966 are partly estimated or provisional.

Tables 1 to 3

Item 1 Balance of trade: on transactions basis.

Item 5 Long-term private capital: includes the long-term capital transactions of banks.

Item 7 Special government transactions: advance repayment of public debt to the United States, special security purchases effected in the United States by the Canadian government in 1966, advance payments to the United Kingdom on defense imports, conversion of the British government's holdings of American securities into liquid assets.

Item 8 Short-term nonbank capital: residual item which includes statistical discrepancies.

Item 9 Short-term bank lending: item included in item 11, *Foreign exchange transactions of banks* for EEC, four industrial countries and, until 1963, United Kingdom.

Item 10 Overall balance:

The overall account of the United States differs from the American definition on a liquidity basis on the following points: (a) American banks' time deposits at foreign banks are deemed to have the character of foreign exchange; (b) of the nonmarketable U. S. government medium-term bonds held by foreign official institutions, the nonconvertible bonds are also regarded as liquid liabilities, except those which have been placed with the Canadian government in connection with the Columbia River project; so are marketable deposit notes, with an original life of more than one year, held by national monetary authorities.

The overall account of the United Kingdom differs from the British definition on the following points: (a) the liquid assets obtained through the conversion of British government's American securities have been successively added to the foreign exchange reserve; (b) transactions connected with the liquidation of the European Payments Union are regarded as a financing item, whereas the item "miscellaneous capital" and British banks' external sterling claims are not.

Item 12d Reserve position in IMF: gold and super gold tranches.

Item 12e Liabilities to IMF: liabilities due to drawings within the credit tranches as well as the United States' and the United Kingdom's liabilities in respect of gold deposited by the IMF in connection with the general increase of quotas.

Item 12f EPU position: transactions connected with the liquidation of the European Payments Union.

N.B.: Table 4—derived from the data of Tables 1 to 3. The breakdown by years of the balance of payments of the "other non-Ten" (Canada, Japan, Sweden, Switzerland) and of the other countries is not reproduced here.

In the column "Total" the excess of the balance of trade (line 1) and the increase in net official reserves (line 12) correspond with the change in the world's stock of monetary gold.

N.B. Table 5—derived from the data of Tables 1 to 3.

Notes of Table 5: SOURCE: IFS and BIS reports.

The regular IMF gold transactions include the payments of gold in connection with increase in quotas or with payment of charges, and the sales of gold by the IMF.

Special IMF gold transactions include investments in U.S. securities of 0.3 in 1959 and 0.3 in 1960 and general deposits of 0.25 in U.S. and U.K. in 1966. These transactions have created additional gold reserves without a related decline of Fund reserve positions.

INTERNATIONAL LIQUIDITY: AN UNOFFICIAL VIEW
OF THE U.S. CASE

By FRANCIS M. BATOR
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Time does not permit a full exposition of the U.S. case on international money. In broad outline, omitting refinement and qualification, the core of the case would seem to me as follows:[1]

1. By 1965—when the U.S. government, led by Secretary Henry Fowler, launched the crucial phase of the enterprise which came to a point in Rio—it was obvious that the international monetary arrangements then in force were likely to land the world in very hot water, irrespective of what happened to the U.S. payments deficit. With fixed exchange rates and any change in cross rates between major currencies considered a massive gamble (in one instance probably unacceptable to most governments); with reserves consisting largely of gold, dollars, and sterling, and gold the only external source of new net reserves for the world as a whole; and with the U.S. commitment to gold at $35 per ounce—it seemed likely that no configuration of the U.S. balance of payments (by whatever accounting definition of "deficit" or "surplus") could significantly reduce the high probability of trouble.

It was clear that a sharp shrinkage of the U.S. deficit could easily lead to cumulative beggar-thy-neighbor restrictionism, with internal deflation and restrictions on trade and capital flows breeding more deflation and more restrictions. Further, the prospect of more fierce competition for reserves among governments could tempt private speculators to bet even more heavily on a rise in the price of gold.

It was equally clear that—in the absence of really dependable cooperation among the larger central banks in the short run and reform in the longer run—a continuing large U.S. deficit would risk, with increasing probability over time, heavy private and small central bank gold speculation, growing nervousness among the big dollar-holding central banks, and continuing exposure to a bear raid on the dollar which would force the U.S. to close up shop in New York and to renegotiate the international money rules in a setting of crisis.

Under the 1965 rules of the game, it is more likely than not that there was no room at all between the devil and the sea, that no profile of U.S.

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[1] It need hardly be said that the following is my private, personal view of the U. S. case. It is not an attempt to construct a composite picture of the views held by the relevant officials of the U. S. government during 1965–67. There is, of course, some overlap. But for the official position the reader should consult the speeches and statements of Secretary Fowler. Those, and only those, have standing.

deficits-surpluses could reduce the betting odds on trouble to a comfortable level. (If there was room, it is most unlikely that even an improbably skillful manager of economic policy, quite free of political constraint, could find such a path to safety.)

2. Over the past dozen years, a host of economists have laid bare the underlying flaws in the system. In terms of the likely behavior of governments:

a) With fixed exchange rates, there is no built-in mechanism of continuing adjustment such as would prevent persistent deficits and surpluses. Prevention, or more to the point, correction requires purposeful action by governments. (It does not follow that any feasible system of flexible or floating rates would be even tolerably efficient in the absence of such action.)

b) Except under fortuitous circumstances, when the economics of adjustment seem painless or even enjoyable, governments regard the prospect of having to take corrective action as painful—painful in terms of their domestic or international politics. There is not enough political consensus on who should do what and when to protect a government imposing economic pain on its citizens, or on other governments' citizens, against retaliation.

c) For a lot of reasons—some eminently sensible in terms of economics; others close to nonsense in terms of economics, but real enough in terms of domestic or international politics—governments tend to regard the prospect of being forced to take action to cure a deficit much more unpleasant than the prospect of having to reduce a surplus. Given the implicit power relations between deficit and surplus countries—one can run down reserves only so long as one has some, but there is no upper limit to accumulation—and given the presumedly greater cost of being forced to fix a deficit (as against the lesser cost of being passively subjected while in surplus to the adjustment actions of those in deficit), it is not surprising that governments of the advanced industrial countries are scared to death by the prospect of a persistent deficit and rather smug about a persistent surplus. Deficit phobia—and the nightmare of running out of reserves while being lectured by those in surplus as they happily build up their nest egg of reserves and refuse to take or even passively accept corrective action themselves—is reinforced by the political bite of the morality play which equates deficits (and devaluation) with sin and surpluses with virtue.

d) The preference of governments is not merely to be spared deficits but to hedge against future failure by accumulating reserves in some relation with output and trade, thereby reducing the pain of such failure. Everyone would like to be in persistent surplus. Yet it is an arithmetic truism that, even apart from the deficit bias in the way many govern-

ments keep their books, some are bound to fail—unless the sum of the desired surpluses, worldwide, is no greater than the increase in the externally provided stock of owned reserves; i.e., under the pre-SDR rules, the stock of monetary gold.

e) We have no econometric confirmation of the reserve or balance-of-payments targets of governments. Even less hard evidence is at hand on how particular governments when put to it would trade off reserves or protection of the exchange rate against other goals (employment, growth, etc.). On circumstantial evidence, it is a good bet that, as a matter of trend and under the present setup, *ex ante* demand for extra reserves when added to industrial demand for gold is a good deal larger than the supply of gold. At the least, enough private speculators think so to make it so.

f) This suggests that under the existing (pre-SDR) rules there does not exist a set of infrequently adjusted cross rates between currencies which would eliminate the excess demand for gold as long as (1) gold is the only source of external (net) reserves to the world as a whole, (2) the price of gold remains at $35 per ounce, and (3) the U.S. commitment to purchase gold at $35 from all comers makes that price a credible floor. In the aggregate, governments' balance-of-payments objectives are inconsistent. It is a case of everyone wanting to be taller than the average.

g) In a world where governments tilt against each other for inconsistent surpluses and extra reserves—some by choice, others because in the absence of finance they have no choice but to try to protect themselves against deficits—the "winners" are likely to be countries with the least distaste for deflation and unemployment and the most distaste for inflation, and/or countries with the least distaste for autarky. They are likely to win in three senses: they will tend to get all the new reserves, and then some; they will shift onto others the burden of having periodically to take ill-tasting adjustment medicine; most important, their tastes will tend to dominate with respect to the inflation-unemployment trade-off, and/or with respect to the rules governing trade and payments (as against the tastes of those less willing to tolerate unemployment for the sake of price stability, and more persistently committed to liberal trade and payments).[2]

h) Until recently, the above has been masked, albeit thinly, and the world spared the damaging effects, because the U.S. and the rest of the world have been prepared (no matter with what blend of gratification and discomfort on the part of each) to let the U.S. play the role of

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[2] Anyone fond of the anti-inflationary discipline implied by the first part of the proposition should carefully contemplate the economic and political implications of the second part. In the end, a world of comprehensive trade and exchange controls is a more likely outcome than a world of no inflation.

world central bank, pumping out liquidity, increasing its liquid liabilities but also running down its gross reserves, letting others satisfy their desire for surpluses and reserves. But with the rules on gold a perfect setup for Gresham's law, it didn't take much anxiety about the instability of the situation—or about the quantitative result, or about the U.S. having "unilateral" control of the printing press (as though our deficit were not the mirror image of others' surpluses)—to convince a lot of people that this can't go on. And it took only a few so convinced to assure that it can't. With the U.S. determined to join the rest of the human race in trying to get into surplus and build up its net reserves— the cost of failure being a massive run on gold and forced surgery— something has to give.

3. In theory, the best way to get out of this corner—the only way really to get out—would be to reduce the demand for reserves by providing for a politically more palatable, quasi-automatic mechanism of adjustment. This would suggest, by elimination, some regime of floating rates. (Domestic fiscal and monetary instruments are just barely a match, even on paper, for important domestic objectives pertaining to total demand and the price level/unemployment trade-off, the public-private mix, the consumption-investment mix, and income distribution. And capital and trade controls are not only bad economics, but, especially in the long term, very bad international politics. With fixed exchange rates, there remains no efficient, widely accepted instrument for correcting imbalance. The system is overdetermined. In terms of the standard linear metaphor, the number of independent equations— constraints, goals—exceeds the number of variables.)[3]

But whatever the case for greater flexibility in rates, in 1965–67, with presumedly excess dollars hanging over the foreign exchange markets, it was not a case the U.S. government could advance. It could not have done so even if it had been tempted on the merits, which it was not. (Quite apart from the problem of how to get there, I believe the case is very far from clear. Temporary fluctuations are much better dealt with by letting reserves run up and down. And in the face of persistent one-way movements, destabilizing speculation, deeply discouraging to trade and investment, would be a very tough problem. But in any case, even if one were convinced that the flexible-rate tiger is a tamer tiger than the one we are riding, the operative question cannot be settled by one's steady-state preference.)[4]

4. With no easy way to reduce the demand for reserves by easing the

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[3] I do not believe that the usual qualifications involving twisting yield curves, changes in tax structure, etc., significantly weaken the point.

[4] This does not imply that we should give up on finding a greater role for exchange rates. I am inclined to think that this should be high on the agenda of hard thought about where we go from here, once the SDR is in operation.

process of adjustment, the alternative was to do something about supply.

A rise in the price of gold was judged, rightly I think, a medieval expedient, inefficient in providing for the need (which is for a continuous, relatively smooth expansion in reserves), inequitable in its first round benefits, and, given the history, politically out of the question.

Unilateral U.S. action to induce the world—or at least that part of the world not prepared to join a gold bloc and float against the dollar—to crown the dollar, making it invulnerable to Gresham, was another theoretical option which was ruled out. Not without its temptations in the face of the chorus of moralizing by the surplus countries, this, a Roman solution, would have given the U.S. close to unilateral control of the printing press, but quite possibly at grave political cost. As long as there is a chance for reasonable, cooperative solutions by consensus, it is wrong for a great power to resort to war.

That left some sort of new supplementary reserve asset. The SDR, even when in circulation in substantial amounts, will not solve all our problems. With three reserve assets in play, Gresham will remain to plague us. (The U.S. fought against any sort of fixed proportions "sandwich," because the ratio which might have been negotiable, particularly in a three-layer arrangement, would have resulted in a very restrictive outcome.) Persistent disequilibria will remain a problem, especially in situations where market-clearing cross rates continue to move in one direction because countries have different preferences as between inflation and unemployment. Last, for the near term, Rio may have come too late to avoid trouble; much will depend on the capacity of the large central banks for really dependable cooperation. But if we manage to get through the transition without crisis (the fact of agreement at Rio should help some) and once the SDR scheme is in operation, we will have taken a very long step toward rational management of international money.

THE RELEVANCE OF INTERNATIONAL LIQUIDITY TO DEVELOPED COUNTRIES

By Richard N. Cooper
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I

It is not necessary to repeat here the usual arguments concerning the need for improving the quality and the mechanisms for increasing the quantity of international liquidity[1]: the well-known shortage of gold at the prevailing price, the erratic element introduced into world reserve growth by linking it with a single nation's balance of payments, the perhaps overemphasized risks of confidence crises arising from reliance on a national currency such as the dollar, and so on. Rather, I will focus on the relationship between liquidity and balance-of-payments adjustment under a regime of fixed exchange rates, on the nature of disturbances to the balance of payments, on the reasons for differing opinions regarding the appropriate growth of liquidity, and on the consequences of inadequate liquidity. The frame of reference will be transactions among developed countries—countries that have convertible currencies and have agreed to eschew direct controls over trade and payments; but the following remarks are not wholly inapplicable to other countries as well. It will be assumed that international payments are in long-run equilibrium, achieved if necessary by occasional changes in exchange rate parities to correct any "fundamental disequilibrium" under the Bretton Woods rules of the game. We are therefore concerned with payments deficits which can be expected to disappear in the course of time.

To focus on the relationship between liquidity and adjustment neglects other arguments for increasing international liquidity. One of these arguments, promulgated especially by the Netherlands Bank, relates needed reserves to the total value of liquid assets held domestically. Reserves apparently represent precautionary holdings against a run on the currency by residents, much as a commercial bank holds some proportion of its total deposit liabilities in readily accessible form. In

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[1] International reserves are acceptable means of international payment held by national monetary authorities to be used to support the nation's exchange rate during periods in which total payments to foreigners exceed total receipts from foreigners. It is conventional to regard as international reserves gold, convertible currencies—notably the dollar, the pound sterling, and (within the franc area) the French franc—and, increasingly, the "reserve position" at the International Monetary Fund. International liquidity is a broader and vaguer concept, encompassing not only international reserves but also ready access by monetary authorities to acceptable means of international settlement, such as swap arrangements between central banks or conditional drawing rights on the IMF.

this sense international reserves would represent "backing" for the domestic currency, designed partly to instill confidence and partly to meet successfully a "run" by residents in the unlikely event it should arise. On this view reserves are valued chiefly for their balance-sheet role and in the best of worlds would not have to be used. Furthermore, other kinds of liquidity offer only a partial substitute for reserves.

In contrast, the view taken here is that international liquidity exists to finance payments deficits, with the aim of protecting both domestic and foreign policies against undue pressure from the balance of payments; it should not merely play the role of a finely dressed mannequin placed in a show window to impress passersby. In practice these two needs conflict to the extent that countries are reluctant to use reserves to finance payments deficits because that would (even temporarily) worsen the "balance sheet" and thus weaken confidence in a currency for which the public has come to expect a certain relation of reserves to domestic assets. But the "appropriate" balance-sheet relationship is based on convention rather than analysis and is undoubtedly subject to gradual reduction through persuasion and practice.[2]

II

Any *ex ante* deficit of given size arising from some disturbance to a preexisting equilibrium can either be financed or it can be eliminated through some offsetting action. Following H. G. Johnson, it is useful to classify policies for reducing current account deficits into two broad categories: expenditure-reducing policies and expenditure-switching policies. The first involve measures that improve the trade balance by reducing the level of aggregate demand; the second involve measures, such as import quotas or surcharges and export subsidies, which switch home and/or foreign demand from foreign to domestic products.

These three possible ways to cope with an *ex ante* deficit—expenditure reduction (D), expenditure switching (E), and financing (F)—can be illustrated with an equilateral triangle, the three vertices of which represent exclusive use of each of the three alternatives. The size of the triangle indicates the *ex ante* deficit, and any point in the triangle indicates the portion of the deficit that is covered by each of the three methods. Thus in Figure 1 the point A indicates that of the total *ex ante* deficit EF, CF was eliminated by expenditure-switching policies, BC was eliminated by expenditure-reducing policies, and the remainder, EB, was financed. EB was the observed deficit. The same proportions could of course be read off either of the other two sides, after sketching

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[2] This possible conflict between "reserves for use" and "reserves for holding" suggests that new forms of international liquidity should include nonreserve components that will actually be used rather than merely held. The "special drawing right" at the IMF straddles the two forms.
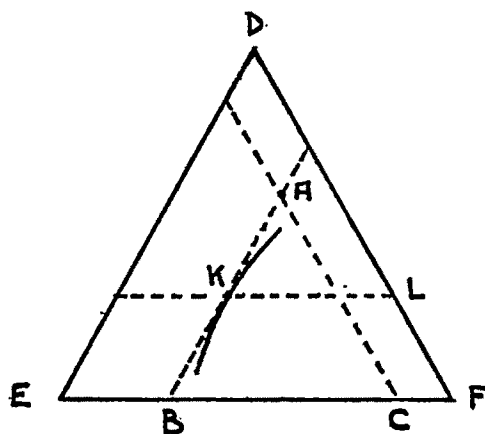
FIGURE 1

in a horizontal line through A. At E the entire deficit would be elimi-
nated by restrictions or other expenditure-switching policies; D and F
represent exclusive use of expenditure-reducing policies and financing,
respectively. The time period covered can be assumed to be the total
period during which the *ex ante* deficit exists. This formulation requires
specifying the "normal" level of aggregate demand (e.g., in terms of
unemployment rate) and the normal degree of policy restraint on
international transactions (e.g., in terms of tariffs imposed for protec-
tion or revenue).

Looking at the problem in this way serves to remind us of two proposi-
tions. First, the *ex post* deficit is not typically the best measure of the
size of the problem, since other objectives may have been sacrificed to
reduce an even larger prospective deficit. Second, there is a three-way
trade-off between financing and adjustment through expenditure
reduction and adjustment through expenditure switching. The more we
have of one, the less we need of the other two. Moreover, we cannot
specify objectives with respect to the three methods independently, for
example, by ruling out export subsidies and restrictions on international
transactions, by setting high employment goals to be maintained at all
times, and by keeping a tight rein on the possibilities for financing
payments deficits. The three categories are meant to be exhaustive in a
regime of fixed exchange rates; given the size of the deficit, some com-
bination of them must be used, no matter what our feelings or rules
about them. Thus for a given amount of usable liquidity EB confined by
the line BA, national preferences may yield a preferred mix[3] between

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[3] This preferred mix, indicated in Figure 1 by an indifference curve, is likely to vary from
country to country, not only on grounds of ideology—laissez faire versus economic manage-
ment—but also in terms of the comparative costs of alternative policies. For a given improve-
ment in the balance of payments, expenditure reduction is more costly in terms of lost output,
relative expenditure switching, for a large and diversified economy with a small foreign trade

expenditure reduction and expenditure switching at K. But international rules and conventions may prevent greater use of switching policies than that indicated by the line CA. In that case objectives are incompatible, and either the country must compromise its own national preferences (by moving to A) or it must violate the international rules. Both phenomena have been observed in recent years.

This frame of reference must be modified to allow for private international capital movements, where the distinction between expenditure-reducing policies and expenditure-switching policies is not so apparently relevant. But capital movements, like current account transactions, can be subjected to quota restrictions, tariffs, and other restraints. They can also be influenced by monetary policy. It seems symmetrical to group the former with expenditure-switching policies, designating them together as "external measures," that is, measures designed to influence international transactions directly (E in Figure 1), while monetary policy can be grouped with expenditure-reducing policies as "domestic measures"; that is, measures designed to affect the balance of payments indirectly by operating on the level of domestic expenditure and asset holdings (D in Figure 1).

The suggestion is often heard these days that a country can reduce an *ex ante* deficit by changing the "mix" between monetary and fiscal policy—both domestic measures in the above scheme. Monetary policy could be geared to induce the required capital inflow or outflow, and whatever unwanted depressing effect that might have on the level of economic activity could be offset by a more expansionary fiscal policy. This manipulation of the monetary-fiscal mix does involve, however, the virtual abandonment of monetary policy for purposes other than the balance of payments; it requires a very supple fiscal policy, more flexible than that currently enjoyed in most countries; it presupposes that capital markets are well developed and creditors are able and willing to supply funds to finance even large deficits in response to interest incentives, whether or not they "approve" of the government in question; and it represents only a short-term solution—quite appropriate in the context considered here—and offers no substitute in the presence of fundamental disequilibrium for changes in exchange rates.

In a regime of fixed exchange rates the amount of international liquidity needed depends therefore in a crucial way on the acceptable degree of flexibility in using external measures, on the acceptable degree of flexibility in using monetary and fiscal policy to achieve correction in the balance of payments and (related) the degree to which equil-

sector than for a small and more specialized economy with a large foreign trade sector. Drawing BA parallel to DE implies unconditional liquidity; but conditional liquidity—such as drawing rights on the IMF—may tilt BA relative to DE, indicating more liquidity will be made available if restrictions are avoided, for example.

ibrating flows of private capital can be relied upon, and, finally, not least, on the size of the prospective imbalances requiring action. It is to this last point that we now turn.

III

As time goes on, the absolute size of payments imbalances (the size of the triangle) may be expected to grow. Britain's trade imbalances today exceed its total trade in Napoleon's day or even at the turn of the century, and the same is no doubt true of most other countries. But the precise relationship between growth in income and trade, on the one hand, and economic disturbances and payments imbalances, on the other, is highly complex. At best we can only sketch some considerations that bear on that relationship, with no pretense at precision.

We are concerned here with disturbances to the balance of payments, and it is possible to identify three quite different aspects of these disturbances. The first involves disturbances to the economic system— "exogenous" disturbances arising from changes in tastes, technology, and government demand that might take place even in a closed economy. The second involves the impact on other countries of such disturbances taking place in one country; i.e., the international transmission of domestic disturbances. The third involves the nature and timing of policy responses to these disturbances in several countries, since policy responses that are not coordinated among countries can themselves prolong or lead to payments imbalances.

It is difficult to say much about the first of these components. Domestic disturbances might be expected to grow roughly in parallel with GNP. The growing size of the government sector in most countries might tend to raise the ratio of disturbances (strictly, their standard deviation) to GNP, but the universal decline of the agricultural sector in developed countries would tend to lower it. The growing diversity in production in most developed countries might be expected to lower the ratio, but the growing influence, nationwide, of advertising on consumption patterns may be expected to raise it. A priori considerations do not lead us very far.

We are less ignorant about the second element. A given domestic disturbance is transmitted to other countries with a magnitude depending on such economic parameters as marginal propensities to import, price elasticities of demand for imports and supply of exports, and the international interest (and tax) sensitivity of capital. On the whole, these parameters have undoubtedly risen substantially among developed countries since the 1940's and early 1950's, as natural and artificial barriers to trade and capital movements have declined, as communications have improved, and as modern techniques of production have become more widely diffused. Furthermore, the trend toward

greater interdependence may be expected to continue, barring policy measures to reduce the economic interdependence among countries. These developments suggest that *ex ante* disturbances to the balance of payments may be expected to increase more rapidly than do the domestic disturbances that underlie them. But these same developments also increase the influence of corrective measures over the balance of payments. For example, higher marginal propensities to import imply a given shift in investment will have a larger effect on the trade balance; but so will a given shift in fiscal policy.[4] For this reason, the need for liquidity may not increase even though *ex ante* imbalances in payments have increased.[5]

The third determinant of payments imbalances arises from government attempts to pursue national economic objectives independently, so different governments are sometimes working at cross-purposes. With growing economic interdependence among countries, failure to take into account the policy actions of others, and to allow for the impact of one's own actions on the actions of others, will put heavy demands on reserves during the process of restoring the economy to a desired state following some disturbance.[6] This is an avoidable increase in liquidity requirements, but avoidance requires much closer coordination of economic policies among industrial countries—with an apparent loss of national sovereignty in the process.

IV

The foregoing admittedly has a rather abstract and tentative flavor. But if it can be accepted as broadly correct, it suggests a growing need for international liquidity to cover imbalances in payments, with some presumption that liquidity should grow at least as rapidly as the level of economic activity. Why, then, are there apparently sharp differences of opinion on the need for additional international liquidity? I venture to guess the differences arise from three sources.[7]

The first, and most important, concerns differing judgments about the nature of the domestic disturbances. Some observers, especially in Europe, feel that disturbances to the balance of payments arise

[4] These two propositions are demonstrated more formally—using a very simple two-country model—in the appendix.

[5] This conclusion assumes that our objectives are "proportional" to the size of the economy; e.g., we focus on the rate of unemployment rather than the level of unemployment. Moreover, a diminution in our tolerance for variations in unemployment as our ability to influence the level of aggregate demand improves would require a larger increase in liquidity than the text implies.

[6] This proposition is shown more formally, and by illustration, in my "Macroeconomic Policy Adjustment in Interdependent Economies," *Q.J.E.* (forthcoming).

[7] Nations have been jockeying for control of the mechanisms that generate international liquidity, and this gives rise to numerous apparent differences of view introduced for tactical reasons in the context of negotiations. I focus on differences that seem to have some analytical interest.

predominantly or largely as a result of mismanagement of monetary and fiscal policies by governments. They argue, moreover, that the likelihood of mismanagement is closely related to the degree of international liquidity available and that balance-of-payments "discipline," i.e., the inability to finance deficits easily, is necessary to induce or compel governments to adopt appropriate policies. On this view, the separation implicity made above between "disturbance" and "adjustment" is a misleading one; on the contrary, there is thought to be a strong interaction between the two, with more liberal financing facilities leading to larger disturbances.

It is difficult to test this hypothesis empirically against the alternative one that inappropriate macroeconomic policies are not the chief cause of imbalances in payments. This difficulty arises in part because the notion of "appropriate" policies is itself ambiguous. Appropriate with respect to what? Obviously not with respect to the balance of payments, for that would be tautological—although some statements seem to have precisely this tautology in mind: payments deficits imply mismanagement of demand.

An alternative definition of appropriate policy takes as its starting point widespread government acceptance of responsibility for maintaining economic stability with a reasonably low level of unemployment.

Whether or not the timing or magnitude of fiscal or monetary measures actually "caused" variations in economic activity, we might hold macroeconomic policy responsible for having failed to achieve domestic stability. It would then be possible to calculate what national payments positions would have looked like if macroeconomic policies had held the economy continuously on an even keel. This calculation would then give some idea, albeit an imperfect one, about the extent to which inappropriate macroeconomic policies were in fact the source of imbalances in international payments.

Such a calculation for the United Kingdom, which is the only country I have tested, yields the interesting result that about half—53 percent to be precise—of the year-to-year variations in Britain's balance on current and long-term capital account can be attributed to the failure of macroeconomic policy to keep the rate of unemployment unchanged at 1.6 percent of the civilian labor force over the period 1955–66.[8] The

[8] Conceptually, the balance of payments (B_t) in any period (t) may be related directly or indirectly to the unemployment rate (u_t) thus: $B_t = b_u u_t + \epsilon_t$, where ϵ_t is an error term uncorrelated with u_t. Then $\sigma_B{}^2 = b^2 \sigma_u{}^2 + \sigma_\epsilon{}^2$, where $\sigma_B{}^2$ signifies the variance of the balance of payments, etc. Appropriate management of demand here implies $\sigma_u = 0$, so the index of mismanagement in the text is $1 - \sigma_\epsilon{}^2/\sigma_B{}^2$. The calculations underlying the result reported here related unemployment to GDP and GDP to imports. The results are described in my "Britain's Balance of Payments: Choices Among Conflicting Objectives," in Richard E. Caves (ed.), *Britain's Economic Prospects* (Brookings Institution, forthcoming).

remaining half was due to other causes, some no doubt originating inside Britain and others originating outside. This result is somewhat surprising in view of the fact that Britain's "stop-go" economic policy was supposedly governed by balance-of-payments considerations, and one might have expected Britain's economic policy to be stabilizing with respect to the balance of payments rather than destabilizing, as it apparently was. Ironically, in this case the provision of more liquidity to Britain might actually have reduced the need for liquidity to finance payments deficits—provided the British authorities would have gotten the unemployment rate to 1.6 percent and kept it there.

This one piece of evidence suggests a fifty-fifty division between the two hypotheses regarding the nature of disturbances to the balance of payments. The above calculation, however, implicitly imputes all variations in unemployment rates to "mismanagement" of macroeconomic policy, and that undoubtedly places a greater burden on policy than even the strongest advocate of government management of aggregate demand would claim it could bear. To that extent, the balance of evidence shifts to the first hypothesis, attributing disturbances to factors other than government mismanagement. On the other hand, Britain's balance-of-payments position had a marked downward trend during the 1955–66 period, even with unchanged unemployment rates, and some observers would attribute that to an ill-conceived attempt to run the economy at too high a pressure of demand, on average, throughout the period. One result was a rise in British export prices relative to those of its competitors. Whether this development represented "mismanagement" or correct management leading to a fundamental disequilibrium involves value judgments it is not necessary to make here. But if all of the secular deterioration is attributed to mismanagement, then the year-to-year variation in Britain's payments position explained by mismanagement rises to 71 percent, leaving 29 percent to other factors.[9] This calculation can be regarded as placing an upper limit on the mismanagement hypothesis, since it attributes the entire time trend in Britain's payments position to price-cost developments, with no allowance for the differential growth in Britain's overseas markets, changing supply conditions elsewhere, and other factors affecting the trend. But of course Britain represents a sample of only one, and similar calculations might be made for other countries.

The second major reason for differences of view about the need for additional international liquidity involves differences in national interest with respect to distributing the "burden" of adjustment among countries. When there is one imbalance in payments, there must be at

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[9] Here $1 - \sigma_n^2/\sigma_B^2 = .79$, where $\sigma_n^2 = \sigma_e^2 - C^2\sigma_d^2$, derived from $\epsilon_t = ct + n_t$, c being estimated to take out the time trend in ϵ_t.

least two. How should the required action be divided among countries (including, it should be noted, countries initially in equilibrium, for they will generally not escape the impact of measures taken elsewhere)? Adjustment, no matter what the means, is almost always painful, if only in political terms. If some unpleasant action must be taken, countries in surplus would prefer the action to be taken by countries in deficit; and vice versa. This fact provides a powerful but unfortunate incentive to introduce moralizing into the debate, with each side attempting to attach blame to the other for the imbalance, instead of working out how it may be reduced at least cost to the community of nations.

Ample liquidity tends to shift the pressures for adjustment from deficit to surplus countries. Even if the surplus countries are content to accumulate reserves and take no positive steps to reduce the imbalance, they must choose between accepting the internal inflationary consequences of a balance-of-payments surplus and taking positive action— raising taxes or reducing government expenditures or restricting domestic credit to an extent that they would otherwise not do—to offset the inflationary pressures. Limited supplies of international liquidity, on the other hand, tend to shift the pressure for adjustment from surplus to deficit countries. If the latter cannot finance a deficit, even one limited in duration, they must take steps to reduce it either by domestic measures or by external measures.

This problem of distributing the burden of adjustment will always be present. A "world" welfare function is needed to resolve it. One such function would maximize utilization of productive capacity (subject to normal preferred operating levels) at all times; another would stabilize an index of world prices.[10] The problem of distribution may be resolved in part by recognition that neither surpluses nor deficits are perpetual, so that over the course of time all countries will find themselves on both sides; they therefore have an incentive to reach a reasonable balance of pressures. But in these matters governments have notoriously little time perspective.

Note that the distribution of burden at issue here is not the same as basic national differences in view over the choice between inflation and unemployment. The choice here for the surplus country is between inflation at home and unemployment abroad (*mutatis mutandis* for the deficit country). This choice is very different from inflation versus unemployment at home, and it is quite consistent for surplus countries to be highly sensitive to domestic unemployment and still prefer a tight

[10] Mundell argues that stabilizing a world price index would require countries, whether deficit or surplus, to adjust in inverse proportion to their economic size around a norm of price level stability. See Robert Mundell, "The Proper Division of the Burden of International Adjustment," *National Banking Rev.*, Sept., 1965, pp. 81–87.

rein on international liquidity, which puts pressure on foreign employment.

The third reason for continuing differences in view on the need for additional international liquidity, trailing very much behind the first two in importance, concerns the fact, noted above, that for interdependent economies there is a trade-off between the need for international liquidity and economic cooperation among countries. True internationalists may want a tight rein on liquidity in order to induce and even to compel close cooperation in economic policies as a preferred alternative to other forms of adjustment. This view involves a gamble that the necessary cooperation will come forth before restrictions on international transactions, which would disrupt the desired move toward greater world unity. Coordination of policies cannot eliminate the need for international liquidity, but it can reduce the need substantially where countries have been pursuing policies at cross-purposes, at least with respect to timing. On this view, the emphasis on more international liquidity erroneously accepts the sovereign nation as the appropriate unit for economic policy making.

V

The crucial test of whether or not there is a shortage of liquidity lies not in the growth of liquidity relative to our highly speculative estimates of the growth in disturbances to international payments but in how countries in fact behave with respect to the balance of payments. A shortage of liquidity, on the view taken here that liquidity should be used to protect domestic and foreign policies, would express itself in the unnecessary use of restrictions over international payments or of deflation of domestic demand—unnecessary in the sense that these policies had to be reversed in a relatively short time. Recent experience is not decisive on this point, but it has hardly been reassuring. Britain, Germany, Italy, and Japan—four of the major industrial countries of the world—all felt it necessary during the past decade to deflate at least in part for balance-of-payments reasons, and all went further than they intended in doing so. It can be argued that this simply reflected mismanagement of demand, that some downward adjustment in aggregate demand was necessary in each case, and that greater skill in the management of demand would have avoided overshooting. But it could also be argued that greater liquidity—or a greater willingness to use the liquidity available (most observers would have thought that both Germany and Italy had ample liquidity)—would have permitted a more gradual reduction in demand, with less risk of going too far.

It is also true that after years of successful dismantlement of restrictions on international payments among industrial countries, such

restrictions increased substantially in the mid-1960's. It is less clear that they were associated with temporary deficits. Canada and Britain both imposed and then removed surcharges on imports; but both countries also devalued their currencies before removing them or shortly thereafter. Many restrictions remain, mostly on capital movements out of Britain and the United States and on capital movements into Europe, but also on government purchases in many countries. The current and continuing relevance of international liquidity to developed countries hinges in large part[11] on whether the mix between liquidity and adjustment by use of restrictions is optimal for the world as a whole. If it is thought desirable to retain a world of fixed and rarely changed exchange rate parities, more liquidity will be necessary to avoid the inefficient methods of "partial devaluation" through restrictions as they have been used. Alternatively, if the risks of allowing more generous increases in liquidity, for the reasons given earlier, are thought to be too great, more effort should be devoted to considering what types of restrictions are least inefficient.

APPENDIX

Let

$$Y = C + G + X - M + Z$$
$$C = C(Y)$$
$$M = M(Y)$$
$$X = X(Y') = M'$$

where Y is gross domestic product, C is consumption, X is exports of goods and services, M is imports of goods and services, all in constant prices. G is government expenditures used as the policy variable, and Z represents all other autonomous expenditure, changes in which are "disturbances." Let a similar set of relationships apply for a second country, designated by primed variables. There are only two countries.

Combining terms and differentiating completely yields the following system of simultaneous equations:

$$\begin{bmatrix} s + m & -m' \\ -m & s' + m' \end{bmatrix} \begin{bmatrix} dY \\ dY' \end{bmatrix} = \begin{bmatrix} dZ + dG \\ dZ' + dG' \end{bmatrix}$$

where $s = 1 - \partial C / \partial Y$, $m = \partial M / \partial Y$, and similarly for the second country. Solving,

[11] The mechanism for generating liquidity is also relevant for another problem, not discussed in this paper: the prospect that private demand for gold will increasingly outpace new supplies. Growing recognition of this prospect will stimulate speculative purchases of gold, but the intensity of such speculation is likely to depend very much on the apparent dependence of central banks on gold for international liquidity; i.e., on the alternative forms of liquidity that are available to them.

$$\begin{pmatrix} dY \\ dY' \end{pmatrix} = \frac{1}{\Delta} \begin{bmatrix} s' + m' & m' \\ m & s + m \end{bmatrix} \begin{pmatrix} dZ + dG \\ dZ' + dG' \end{pmatrix}$$

where

$$\Delta = (s + m)(s' + m') - mm' = ss' + ms' + m's$$

This gives the familiar Keynesian foreign trade multipliers with repercussions, in the absence of stabilizing fiscal policy. Define $dB = dX - dM$. $dB' = -dB = 0$ initially. Suppose then $dZ < 0$, $dZ' = 0$, and the primed country takes fiscal action to hold its level of income unchanged. Then in the new equilibrium $dB' = [m/(s+m)]$ from the simple foreign trade multiplier without repercussions. To eliminate its new deficit, the primed country will now have to contract government spending by an amount determined by $dB' = (m's/\Delta)dG'$, on the assumption the unprimed country takes no offsetting fiscal action. This will lead to a reduction in Y' by $dY' = [(s+m)/\Delta]dG' = (m/m's)dZ$.

Suppose now the economic interaction between the two countries is increased by a proportional increase k in m and m'. It follows then (substituting $(1+k)m$ and $(1+k)m'$ for m and m', respectively, in the foregoing relationships) that

$$\frac{\partial}{\partial k}\left(\frac{dB'}{dZ}\right)\bigg|_{\partial Y'=0} = \frac{ms}{[s + (1 + k)m]^2} > 0. \tag{1}$$

$$\frac{\partial}{\partial k}\left(\frac{dY'}{dZ}\right)\bigg|_{dB=0} = \frac{\partial}{\partial k}\left(\frac{m}{m's}\right) = 0. \tag{2}$$

In words: for given dZ the imbalance dB' increases with m, but the impact on income of eliminating this larger imbalance is unchanged if m' has grown by the same proportion.

INTERNATIONAL LIQUIDITY: SYNTHESIS
AND APPRAISAL

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Basic Postulates

Four fundamental postulates underlie the papers which have been presented at this session:

1. Different national objectives among the more—as well as less—developed countries account for their different views on what constitutes an efficacious payments mechanism, with conflicting emphasis on the form and timing of adjustment measures to be used, the conditions and terms for expansion of liquidity, the role and price of gold.

2. The European Economic Community in particular regards the problems related to international liquidity as being inextricably linked with a danger of excessive United States domination of the international financial structure.

3. The two leading liquidity centers—United States and United Kingdom—have in recent years practiced internal and external fiscal, monetary, and exchange rate policies which have militated against international confidence in the long-run stability of their balances of payments.

4. With basic disequilibria in international payments during the past decade, widespread speculation in gold and capital movements has frequently obstructed the operation of the adjustment mechanism and it would be ill-advised to assume that the causes of these disturbances will not continue in the future.

Criteria of Adequate "Need"

Given this environment, economic analysis can perform three tasks: in positive terms, state and test the determinants of the demand for, and supply of, international liquidity; in normative terms, evaluate liquidity "needs" under alternative mechanism-of-adjustment conditions; in policy terms, appraise different sets of monetary-fiscal-switching instruments to achieve stated objectives. Understandably, the participants of this session have endeavored to make contributions to all these problem-solving universes. But their emphasis has varied to the point of disagreement.

Recognizing that international liquidity is a precise sounding term for an inherently imprecise phenomenon, Professors Clower and Lipsey

in their joint paper on, "The Present State of International Liquidity Theory," have stressed the importance of conducting econometric studies on the needs for foreign reserves. They have pointed out that, under either fluctuating or stable exchange rate systems, foreign reserves are required to facilitate the basic needs of foreign trade. Importers and exporters tend to hold foreign "currencies" for transaction, precautionary, and speculative purposes. To the extent that these decisions are motivated by cost-revenue considerations—and the foreign reserve balances are subject to systematic and random fluctuations in current account receipts and payments—variations in the holdings of these balances lend themselves to quantitative economic analysis. Directing attention to models based on alternative specifications, the authors suggest that research along these lines is long overdue.

With stable exchange rates, observe Clower and Lipsey, the amount of official reserves required to meet even the basic needs of foreign trade are a multiple of the volume required under an otherwise identical system with flexible rates. This follows, they assert, from the fact that official reserves are not needed at all under a freely flexible system. In effect, they continue, official holdings of foreign reserves derive from the attempts of national authorities to maintain fixed exchange rates. Allegedly, the national authorities make their decisions in terms of shibboleths and conventions, thereby bringing about excessively high, or low, holdings of reserves. It is therefore recommended that, for these phenomena, economists devise appropriate methods of "rubbish disposal."

Nevertheless, maintain Clower and Lipsey, productive work could be done under prevailing conditions by concentrating on official reserves which are required to allow for the variability in current receipts and payments, as well as for the temporary nonspeculative variations in capital items. Analysis of this kind, however, must still be based on extremely simplified assumptions; namely, fundamental equilibrium at a stable exchange rate, a small country with fixed import prices, fluctuations in receipts and payments subject to disturbances which are random in time or in some way serially correlated.

There is no better alternative, according to the authors, than to conduct such theoretical-quantitative studies on measures of reserve adequacy. These measures would provide estimates of the probability that any given quantity of reserves will suffice to meet a country's needs during a given time interval. Two approaches are formulated: a probability approach with respect to optimal reserves and a comparative approach with respect to optimal and actual reserve figures. Attention is drawn to the fact that calculations of optimal reserves are likely to be extremely sensitive to alternative policies considered. Promising

research, in positive terms, might also lie in the direction of formulating and testing models which specify disequilibrium conditions. Quantitative results have been particularly suggestive in studies analyzing the security provided by given levels of reserves on the assumption that changes in reserves are described by a first-order Markov process of the form $\Delta R_t = \lambda \Delta R_{t-1} + \gamma$. These results, as we shall have occasion to observe, might well help to explain the recent fundamental payments disequilibrium of key Western countries—disequilibria stemming substantially from domestically conditioned causes.

Regarding the analysis of official reserves which are required to provide time for adjustment to a fundamental disequilibrium or to counteract speculative pressures on the exchange rate, Clower and Lipsey consider these problems too closely interwoven with politico-economic-psychological factors to permit even of incomprehensive theorizing. They note that most discussions pertaining to these issues barely rise above the level of social conversation.

We have neither a satisfactory theory for short-run capital movements nor for the short-run behavior of long-run capital movements. In a system of stable exchange rates, moreover, permanent changes in a country's long-run propensity to invest abroad create fundamental disequilibria. The analysis of fundamental disequilibria, however—with speculative crises related to them—is aborted by gross uncertainty. Therefore the assessment of adequate official reserves for normal trading purposes requires the development of techniques that will permit governments to thwart speculation at any required time. Otherwise, the authors claim, measures of reserve adequacy can have no operational significance, for speculative reserves will always have to be held. Concluding in normative and in policy terms, they recommend what they deem a preferable alternative of devising a workable system of flexible exchange rates and simultaneously eliminating gold as a reserve currency.

Relevance to Developed Countries

In his complementary paper on, "The Relevance of International Liquidity to Developed Countries," Professor Cooper also assumes long-run equilibrium in the balance of payments. This is to be realized by occasional adjustments in exchange rates under IMF rules. The discussion, once again, is formulated in positive, normative, and policy terms. But the major emphasis centers in this problem: how to achieve target levels of reserves—as well as target rates of unemployment—for the maintenance of international balance in a world of stable exchange rates without the need for sporadic increases in quantitative controls on trade and capital movements.

Domestic economic disturbances, Cooper believes, will increase with the growth in a country's GNP. This will raise the variability in foreign receipts and payments. Levels of reserve needs will therefore rise. Moreover, the growth in international interdependence will also increase reserve requirements. Consequently, the demand for foreign reserves will grow at an even more rapid rate than GNP.

To the reasons already mentioned for holding reserves, a subset is added which has recently been given prominence. It entails the use of foreign reserves as "backing" for a country's currency. Cooper attaches little economic weight to this means of instilling confidence in, or meeting a run on, a nation's currency by its residents. The major aim of foreign reserves, in his view, is to protect domestic and foreign policies against pressure from the balance of payments. Accordingly, a three-way trade-off is presented between: financing an *ex ante* deficit; reducing the level of aggregate demand; and switching home and/or foreign demand from foreign to domestic products. This formulation requires specifying a "normal" level of aggregate demand, e.g., related to a "normal" level of unemployment and a "normal" degree of policy restraint on international transactions, e.g., related to the GATT rules. In positive terms, given these specifications—and the postulated assumptions—the level of reserve requirements can be determined.

However, in normative and in policy terms, objectives of an economy with respect to the three methods of meeting a deficit cannot be specified independently. Not only might the objectives be incompatible, given the reserves at hand, but the analysis must also be extended to allow for private international capital movements. It is important to know, Cooper suggests, whether these capital movements are sensitive to changes in interest rates. If the answer is in the affirmative, they could be used to forestall any threatened deficit without relying on official financing. He cautions, however, against the exclusive use of monetary policy for external balance and fiscal policy for internal balance. This mix would involve the virtual abandonment of monetary policy for purposes other than managing the balance of payments. In addition, it would require more effective and flexible fiscal policies than are currently available in most countries. Furthermore, the argument is based on the assumption of well-developed capital markets, with creditors able and willing to supply large sums to finance deficits regardless of non-economic considerations.

In a system of fixed exchange rates, Cooper points out, the amount of international liquidity needed to achieve correction in the balance of payments therefore depends on: the acceptable degree of flexibility in using monetary and fiscal policy; the degree to which private capital movements can be relied upon; the restraints and stimulants on trade

and capital transactions; and the size of the prospective imbalance. With increased interdependence among developed countries and with less tolerance for variations in unemployment—both of which he assumes will continue to grow—more coordination in the timing of macro-economic policies among the major Western countries will hence be essential, if reserve requirements are not to expand at yet a more rapid rate. Contrariwise, if uncertainty and incoordination increase, countries will probably be unwilling to tolerate extreme reductions in reserves in any one period. They will be constrained to make sequential decisions with respect to their balance-of-payments policies. This will alter the variance in foreign payments and receipts; should it rise, the need for foreign reserves will further be increased.

In view of these apparent trends, Cooper suggests that the strong differences of opinion regarding the advisability of expanding international liquidity stem from differing judgments about the nature of domestic disturbances; the distribution of the burden of adjustment; and the relationships between economic interdependence, liquidity, and multinational cooperation. His crucial test of reserve adequacy lies in how countries in fact behave with respect to their balance of payments. A shortage of liquidity occurs when unnecessary use is made either of restrictions over international payments or of domestic expenditure reduction—unnecessary in the sense that these policies would have to be reversed in a relatively short time. The relevance of international liquidity to developed countries, he concludes, hinges on whether the mix between liquidity and adjustment by use of restrictions is optimal for the world as a whole. Given a system of fixed—and rarely altered—exchange rates, he believes that more international liquidity will be necessary to avoid the inefficient methods of "partial devaluation" through restrictions as they have been used. Alternatively, if the risks of "generous" liquidity expansion are thought to be too great, Cooper recommends more research be devoted to considering what types of restrictions are least inefficient.

Relevance to Underdeveloped Countries

Professor Kafka, in his paper on, "International Liquidity: Its Present Relevance to the Less Developed Countries," does not regard this relevance to be strikingly different from that of the developed countries. Insofar as different reserve needs are concerned, it is only the relative poverty of the LDC's, he maintains, which provides a systematic difference between the two groups. This alone, he observes, constitutes no presumption with respect to criteria of "reserve need."

He submits that in most developing countries a large number of independent variables affect the "demand" for international liquidity;

but there may not be enough observations to establish, reliably, the functional relationship. Nor does the record of past practice furnish appropriate norms for future decision making, as governments have often acted in an idiosyncratic manner. Much disagreement also arises in interpreting the data on liquidity; they may provide no satisfactory measure of actual "availability." For these reasons, Kafka suggests that qualitative guidelines based on simplified assumptions might yield useful insights on desirable levels of international reserves. He recommends investigations of the way in which various amounts of international liquidity—conditional and unconditional—might make it possible for LDC's to achieve various levels of national welfare.

Kafka analyzes the use of international reserves to finance a basic payments deficit in terms of intended and unintended absorption. He maintains that to the extent this financing permits intended over-absorption and intended underabsorption by the deficit and surplus country, respectively, the increased liquidity raises welfare in both countries. The opposite occurs in the case of unintended overabsorption and unintended underabsorption. He notes the obstruction to the international financial mechanism brought about by a country with a surplus "escaping" the burden of adjustment. Nevertheless, he writes, this might be done to prevent, or postpone, the costly and temporary transfer of resources. A less painful process of adjustment would dampen the rate of structural adjustment in both deficit and surplus countries, thereby reducing the unnecessary costs of related unemployment. It would also promote a less restrictive international economic policy and a more rapid rate of growth in the world economy. The LDC's would especially gain, since a given addition to their GNP is much more important to them than to the industrial countries.

These views, Kafka states, do not provide direct conclusions as to the desirability of expanding the present level of international liquidity. But they suggest, he believes, that the case for greater latitude in financing external deficits—and hence greater "liquidity needs"—may be underestimated. *Inter alia*, it is the lack of precise guidelines that results in excessive caution with respect to the creation of international liquidity. Criteria are therefore required to prevent fluctuations in rates of absorption which would be in excess of those that "economic agents" might desire. These criteria could be quite general, for the available evidence on the operation of the LDC's since the second World War does not lend support to a discriminatory policy. Kafka cites the results of A. I. MacBean's study, and of his own compilations, to the effect that: the foreign trade of the LDC's, on the average, has not been greater in proportion to GNP than that of the developed countries; they have not generally suffered from larger instability in their export

earnings; they have not experienced greater instability in GNP or in internal price levels; variations in their export earnings have shown only a weak negative correlation—and variations in rates of inflation a weak positive correlation—with variations in their economic growth. The instability in export earnings of LDC's as a group, however, has been much greater than that of the industrial countries. But this has mainly been associated with particular exports of certain LDC's. More generally, the LDC's have encountered lower elasticities of demand and supply of imports and exports, increasing their need for larger reserves.

He concludes by presenting a possible case for special liquidity requirements of the LDC's as a group and for individual members in specific instances. The argument rests primarily on the higher incidence of their temporary—but relatively large as a percentage of GNP—payments imbalances. At the very least, Kafka claims, no foundation can be established for the case of comparatively less "liquidity requirements" of the LDC's. This latter view, he writes, has been based on the unsubstantiated belief that the LDC's have exceptional reasons for adopting floating exchange rates, with attendant conclusions regarding a smaller need for international liquidity. He maintains, further, that there is no evidence for the widespread view that the LDC's have been irresponsible in their use of foreign reserves. From 1951 to 1966 the reserves of the two groups of countries have declined in about the same proportion; at the end of 1966 the LDC's as well as the developed countries held reserves equal to about the value of five months of their respective imports.

Kafka expresses confidence in the ability of the LDC's to participate in nondiscriminatory schemes to supplement traditional reserves by way of unconditional financing. It was a considerable accomplishment, he writes, and entirely justifiable for them to have achieved equality of treatment in the Fund's SDR scheme. He ends his paper, however, by directing attention to proposals which have been made for additional uses of the SDR's: development assistance, long-term compensatory finance, and promotion of regional economic integration of LDC's via regional pools of SDR allocations. These, however, "are political problems," and while they are considered to be not impracticable, the expertise of the economist is allegedly not relevant to them.

Appraisal

To economize on time and space I shall appraise these papers in terms of the key issues raised by the contributors on the current relevance of international liquidity to the case of the United Kingdom, the Common Market, and the United States.

1. *"Adequate" Reserves Concept.* When dealing with this matter, the

authors of all the papers appear to concur in the practically universal authoritative opinion that the establishment and development of joint mechanisms for the multinational "central banking" creation of international liquidity is indispensable. But the economic criteria for the expansion of "world bank" reserves—timing, volume, and cost—require further integration with the evolving principles of the IMF. At best, in quantitative terms, SDR's can presently be only a minor international asset of last resort. In any event, there are at least two related, but for purposes of analysis sufficiently distinct, problems: variations in requirements for international reserves as an emergency balance-of-payments problem; long-term variations in requirements of international reserves. In the first case, profit-maximization criteria clearly do not apply; in the second, market processes—public and private—are essential for the efficient, financial equilibration of international accounts. But in both cases, terms such as liquidity "needs," "requirements," "desirability" are meaningful only when related to alternative resource use, prices, and costs.

It is the market mechanism—at different rates of interest for deposits, short-term, intermediate, and long-term international assets—which must primarily continue to serve as the crucial regulator of the demand, supply and composition of international reserve currencies, and gold. For this reason, in addition to the econometric studies recommended by Clower, Lipsey, and Cooper, it would be extremely useful to pursue theoretical and empirical research, directly, on the determinants of the demand and supply schedules of international reserves, with particular emphasis on the prices of international liquidity and of competing assets. An important problem is whether equilibrium between demand and supply for reserves can be attained at prices which are considered by governments to be acceptable costs from the point of view of their general domestic, as well as international, economic policies. In this sense, the appraisal of more or less investment in international reserves, at various times, for developed and underdeveloped countries assumes cogent economic and policy implications.

2. *Demand and Supply Functions of Reserves.* The factors determining demand for international reserves have been carefully formulated in the papers under discussion. To that treatment I wish to add only the following comments. Keynesian liquidity-preference theory has been useful in analyzing demand functions for international reserves; but the theory of supply functions of reserves is much less developed. Even on the demand side, decisions to purchase and hold reserves—strictly on economic grounds—by both official authorities and private commercial banks, are probably strikingly different from those of exporters and importers acting individually. Working balances of commercial

banks have often fluctuated in an erratic manner. As is well known from inventory theory, stocks held to bridge a gap between erratically fluctuating incoming and outgoing streams are not required to be increased in proportion to the size of the streams. If the increase in the volume of foreign trade should occur substantially through an increase in the number of transactions, *ceteris paribus*, the demand for working balances would grow at a lower rate than the growth in the volume of foreign trade.

My colleague, Professor Bent Hansen, has shown that for Swedish commercial banks, the demand for foreign working balances, at a given structure of interest rates, probably increases at a slower pace than the volume of foreign trade. Moreover, the demand for these foreign working balances has been interest elastic ("International Liquidity," Konjuncturinstitut, Stockholm, 1964, p. 17). With increasing industrialization, seasonal fluctuations in foreign trade will probably decline in relative importance. Effective full employment stabilization policies also will reduce the relative demand for foreign reserves. Wealth effects, however, can be expected to operate in the opposite direction; the demand for foreign reserves will probably rise, but we require more information on the probability of their increase or decrease as a percentage of GNP.

On the supply side, the analysis must include the determinants of U.S.—and U.K.—supply functions of short-term and intermediate-term dollar—and sterling—assets. Since the supply of these U.S. assets would be expressed primarily in terms of U.S. demand for key European short-term credits, an appraisal the interdependence of the capital and credit markets of the main Western industrial countries is long overdue. (*The Capital Markets Study*, OECD, 1967, will assist this task.) This is required for more important reasons than even the knowledge it might furnish on approximate reserve trends. As the key liquidity center, the United States is by function vulnerable to attack; an active, continuous defense of its reserve position is unavoidable. Therefore, it must always be prepared to acquire foreign exchange reserves in sufficient volume to counterbalance the foreign-held short-term dollar claims that might be presented. The price for such increased liquidity is, of course, the difference between the cost to the United States of borrowing foreign currency, long-term, and the revenue derived from investing and/or depositing these funds, short-term, in European money markets. Consequently, the determinants of market demand and supply functions (and shifts) of foreign reserves play an important role in influencing the comparative costs—as well as feasibility—of the United States serving efficiently as the pivotal world liquidity center.

3. *Exchange Mechanism and Reserves.* I have no objections whatso-

ever to the recommended forms of analysis by Clower, Lipsey, and Cooper on the basis of assumed random disturbances with basic equilibrium. Studies of this kind constitute the foundations of scientific advance. Criticism directed against the unreality of the assumptions may miss two points: in positive terms, it is only economically motivated behavior, under simplified assumptions, that lends itself to generalized analysis; in normative terms, the authors expressly consider the operation of the international mechanism under different conditions than currently prevail.

Several conclusions of their analysis, however, follow only from particular, implicit assumptions. Thus, they accept the extant position that freely fluctuating exchange rates would render unnecessary the holding of foreign reserves for official purposes. The argument must include the premise that, *ceteris paribus*, the economy would not suffer from extreme variations in its terms of trade. Actually, countries which have experienced fluctuating exchange rates have always found it necessary to maintain foreign reserves for official purposes. I submit that the terms of trade issue may well have been one of the legitimate economic reasons for this practice.

The argument that under identical economic conditions foreign reserves for official purposes in a stable exchange rate system would be a multiple of the volume in a fluctuating system is, of course, incontrovertible. For most countries, I believe, experimentation with greater variations in exchange rates is warranted. But we will need more experience to know whether they inherently tend to generate greater speculation and, therefore, raise the demand for official reserves. Although costs and prices in many LDC's are considerably more flexible downward than in developed countries, Kafka's advocacy of stable exchange rates for them appears to me excessively general.

4. *U.S. Creation of Reserves.* In his paper on, "The Case of the Common Market," Mr. Georges Plescoff argues that the fundamental difficulty facing the international financial system stems from the excess liquidity which the United States has created. This, he says, has impelled the Common Market countries to help finance the U.S. deficit and has eased the American purchase of foreign branch plants. Technically, these are political rather than economic arguments, although interwoven with deep economic considerations. Should they wish, the central banks of EEC certainly could sterilize any increased liquidity which the United States has created. If the American balance of payments were strengthened, the U.S. capital market would probably be in a stronger—rather than weaker—position to finance the acquisition of foreign plants.

Plescoff is correct, however, in stressing that a liquidity center can

in the long run supply increased liquidity only if its balance of payments is in a strong position. The available evidence appears to demonstrate that when the U.S. balance of payments tends to improve, the European demand for U.S. dollars on private account tends to rise. But it is of crucial importance to distinguish between private and official foreign holdings of U.S. assets. Those held on private account, as we would expect, have grown with the market-oriented increased demand for U.S. assets. (See the forthcoming study by J. Herbert Furth, *Foreign Dollar Balances*, National Bureau of Economic Research.) Mr. Plescoff rightly devotes attention to the involuntary holdings of American foreign assets by some European official institutions. Given the aggregate increase in foreign short-term U.S. assets, I concur with him, for the strengthening of the international financial structure and improvement in the U.S. balance of payments is a primary requisite. On the matter of constructing and maintaining an efficacious international financial mechanism, however, I think France's position has been most ill-advised.

5. *Liquidity and Crisis*. In presenting "An Unofficial View of the U.S. Case," Professor Bator has explained that in the period 1965–67, the American government feared an improvement in the U.S. balance of payments might undermine the international financial system by reducing world liquidity. Should this have occurred, it was reasoned, the increased effective demand for reserves would have been directed toward gold, aggravating speculative pressures. Bator correctly reports that the argument was prevalent in official circles. But it appears to have had no basis in theory or fact. Theoretically, an improvement in the U.S. balance of payments would tend to raise the demand for dollars relative to gold and thereby strengthen the value of the dollar. In practice, an examination of the record for 1955–66, on a trend basis, appears to confirm this view. Regarding the more important issue, however, of constructing a tolerable adjustment mechanism, it seems to me that the American position has much to commend it.

The stark fact is that on this issue the disagreement between most industrial countries, on the one side, and France, on the other, fundamentally represents the new versus the old in economics. The problems center in applying the theory and practice of more than three decades of national functional finance to international economics. I have termed it international functional finance: the use of international monetary, fiscal, exchange rate, and investment policy toward balancing the long-term international facets of domestic economic policies rather than short-term balances of payments. (See "U.S. Direct Foreign Investment and the Balance of Payments" in *Industrial Policy of an Integrated Europe and the Supply of Foreign Capital*, Les Presses Universitaires de

France, Paris, 1968.) This approach appears to be consistent with the objectives postulated in the paper by Clower and Lipsey or in those by Cooper, Kafka, Oppenheimer, and Bator, their disagreement on the use of flexible or stable exchange rates notwithstanding. They concur—as does practically the entire economics profession—that an adjustment mechanism tied to gold would fail to accomplish one of the most significant aims of virtually all modern nations; viz., the avoidance of costly, sporadic, and unnecessary deflations and quantitative trade restrictions. To move in that direction would be a giant step backward. However, the inefficacy of the existing financial mechanism could also bring about an overwhelming financial crisis. Therefore, the general recommendations of Cooper, Kafka, Oppenheimer, and Bator on the necessity of improving multinational collaborative efforts in managed international liquidity appear to be unassailable.

Understandably, on some issues the preconditions and terms for such sustained collaboration comprise areas of deep national conflict. Kafka has raised the difficulty of unintended overabsorption by the "economic agents" of a deficit country and unintended underabsorption by those of a surplus country. Even more serious is the conflict of interest alluded to by Plescoff: intended overabsorption by the governments of deficit countries and unintended underabsorption by surplus countries. It should be noted that, in the aggregate, the United States has not practiced overabsorption. Since the second World War, the increase in its stock of long-term foreign assets has exceeded that of its short-term foreign liabilities. Nevertheless, disagreements do arise over the composition of its long-term versus short-term foreign assets. Kafka has also spoken of surplus countries "escaping" the burden of adjustment. Although their accumulation of foreign reserves has doubtless been less costly than the adjustments of deficit countries, the decisions of the surplus countries, as Plescoff has noted, have not been unrelated to uncertainties regarding the operation of the international financial system, as well as to the operation of the national financial systems of the two major liquidity centers.

Cooper has stressed the importance of collaboration in macroeconomic policies. I concur, but evidence has been accumulating to the effect that, in the postwar period, compensatory fiscal policies of the British government have on several occasions operated in a perverse manner. Nor have those of the U.S. government been sufficiently powerful to instill much confidence. Apparently more than collaboration is required. The British, American, and German economies, I suggest, may all have demonstrated strong domestic forces tending to generate comparatively long-term balance-of-payments disequilibria. In Britain, we have

witnessed swings in high and low full employment; in the United States, aggregate national expenditure irrespective of its impact on the balance of payments; in Germany, a high income elasticity for real cash balances. These factors may help to explain the high trend effects in the balance of payments—trend effects which have greatly dampened the speed of adjustment.[1] I also suggest skepticism regarding the record on price stability which Kafka generously attributes to the LDC's; further research is required on the inflationary trend effects on their international payments.

6. *Multinational Creation of Liquidity*. All the authors have agreed that, under prevailing conditions, speculative fluctuations cannot be dealt with by market forces. Most countries, Clower and Lipsey have observed, ideally would require for the necessary time of payments adjustment a volume of reserves sufficient to thwart speculation on any occasion. If strong pressure on an exchange rate would develop, no country could singly withstand a massive run. For these purposes, multinational emergency measures and the intervention of the IMF have been indispensable. But enormous as the voluntary negotiated sums by central banks have been, they are neither entirely appropriate nor adequate to the task. They suffer from unwarranted uncertainty; they are subject to bankers' values, discretion, and sense of timing. To meet speculative crises, balance-of-payments emergencies, and supplementary demand for foreign reserves, therefore, central bank provisions are required. But to obtain such powers within the framework of the IMF would entail agreement among the major nations, not only on general economic policy, but on means and ends concerning such sensitive matters as fiscal, budgetary, monetary, banking, foreign trade, external borrowing, and incomes policies. Considered in this perspective, the SDR agreement represents a fundamental development in the history of international finance. Yet, even with the potentially expanded resources of the IMF, this institution per se still lacks the power to deal with a severe and/or general international liquidity crisis. Its resources—including new SDR's—are likely to prove inadequate rather than excessive to meet a speculative demand for international liquidity.

[1] In some of these cases, building on the suggestions referred to by Clower and Lipsey, if we integrate the changes in reserves with a scaling factor indicating disequilibrating or equilibrating movements in reserves which can be described by a first-order autoregressive scheme: $\Delta R_t = \lambda \Delta R_{t-1} + \gamma$, we may have sufficient information to determine the sign of λ and its absolute size, indicating the relative importance of the disequilibrating or equilibrating forces. $|\lambda| < 1$ implies for a given country that changes in reserves will ultimately converge to $\gamma/1 - \lambda$. This could be reasonable. γ could be 0, +, or −, indicating respectively when the country converges to no change, long-run accretion, or depletion of reserves. "Stop-Go" countries (such as U.K. or Japan) would have $-1 < \lambda < 0$. More usual cases would be $0 < \lambda < 1$.

Conclusion

There is, I believe, a dire need to strengthen the system. Two approaches appear to be available.

The U.S. government might continue to pursue its efforts in negotiating for the establishment of nonrestrictive, generous SDR rules, and for a broad code of mechanism-of-adjustment policies applicable to surplus and deficit countries, and aiming to promote steady as well as substantial economic growth and international equilibrium. It might also reconsider its own position and recommend that the rules of the IMF be altered, granting countries the right, should they desire, to permit their currencies to fluctuate 5 percent either side of par in terms of gold and to revalue their par rate by ±2 percent per annum. On an experimental basis, this kind of policy might have much to commend it. Should experience warrant, many countries could adopt freely fluctuating exchange rates. But for the United States, as the main liquidity center, I believe this is neither economically desirable nor practicable. In any event, if multinational terms for the achievement of more liberal financing would include the raising of the price of gold, the U.S. long-term national interest would not be well served. Expectations of a rising gold price should be thwarted; if they are substantiated by experience, speculation will keep raising the price of gold and its supply for monetary purposes will tend to fall, not rise. An IMF managed system of international liquidity ought—in normative terms—to reduce the importance of gold, not increase it.

The conclusion appears to be that multinational efforts should vigorously be pursued within the IMF and other organizations to strengthen the international financial structure. For the near future, however, it is most unlikely that the results will produce a system strong enough to withstand serious balance-of-payments strains.

As the major liquidity center, the United States has both the obligation and responsibility to improve the operation of the international financial mechanism. Accordingly, the 25 percent gold reserve requirement against Federal Reserve notes should be abolished. This gold should be deposited into an exchange equalization account and utilized by the Treasury to help maintain the value of the dollar. The potential gravity of the present situation warrants, I believe, that the United States abandon its gold policy and adopt current-account convertibility. To avoid speculation and evasion, there should be one domestic price of gold at the current level. As a national problem, the balance of payments should be given genuinely high priority. With this in view, the U.S. Treasury should establish a five-year external budget; specific targets should be set for the current and capital account. Although it is hoped that, in the long pull, current account convertibility will en-

tirely remove the necessity for direct controls over capital movements, for this period a capital-issue committee should be established with powers to supervise, register, and control direct and indirect, long-term and short-term capital movements beyond prescribed limits.

If the basic postulates and analysis of the papers presented at this session are correct, international liquidity crises appear to be imminent. The U.S. adoption of current-account convertibility, with close inter-central-bank cooperation, appears to be an essential complement both to the evolving IMF policies and to the buttressing of the international financial structure.

THE NEW INDUSTRIAL STATE

THE MILITARY-INDUSTRIAL COMPLEX AND
THE NEW INDUSTRIAL STATE

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In *The New Industrial State* [7], Galbraith finds that the giant corporation has achieved such dominance of American industry that it can control its environment and immunize itself from the discipline of all exogenous control mechanisms—especially the competitive market. Through separation of ownership from management, it has emancipated itself from the control of stockholders. By reinvestment of profits, it has eliminated the influence of the financier and the capital 'market. By brainwashing its clientele, it has insulated itself from consumer sovereignty. By possession of market power, it has come to dominate both suppliers and customers. By judicious identification with, and manipulation of, the state, it has achieved autonomy from government control. Whatever it cannot do for itself to assure survival and growth, a compliant government does on its behalf—assuring the maintenance of full employment; eliminating the risk of and subsidizing the investment in research and development; and assuring the supply of scientific and technical skills required by the modern technostructure. In return for this privileged autonomy, the industrial giant performs society's planning function. And this, according to Galbraith, is inevitable because technological imperatives dictate it. The market is dead, we are told; and there is no good reason to regret its passing.

This blueprint for technocracy, private socialism, and the corporate state suffers from three fundamental defects. First, it rests on the unproved premise that corporate giantism is an inevitable product of technological determinism. Second, it rests on the increasingly more dubious assumption that industrial and political power are confined to separate, distinct, and hermetically sealed compartments. Finally, it offers no policy guidance, and ignores the crucial questions of responsibility and accountability. If industrial giants, freed from all traditional checks and balances, are to perform society's planning function, what standards shall they use and what assurance is there of an automatic convergence between private and public advantage? What are the

safeguards—other than the intellectual in politics—against arbitrary abuse of power, capricious, or defective decision making? Must society legitimize a self-sustaining, self-serving, self-justifying, and self-perpetuating industrial oligarchy as the price for efficiency and progress?

In this paper, I shall eschew a dreary and repetitive recital of the voluminous evidence that negates the Galbraith version of a crude technological determinism [18, pp. 11–27, 53–66] [20]. I shall also spare the reader any comments on the virtues of private planning—the proposition that what is good for General Motors is good for the country. Instead, I shall offer an alternative (and, hopefully, more realistic) explanation of the current levels of industrial concentration, in general, and the military-industrial complex, in particular.

I

My hypothesis—the obverse of Galbraith's—holds that industrial concentration is not the inevitable outgrowth of economic and technical forces, nor the product of spontaneous generation or natural selection. In this era of big government, concentration is often the result of unwise, man-made, discriminatory, privilege-creating governmental action. Defense contracts, R and D support, patent policy, tax privileges, stockpiling arrangements, tariffs and quotas, subsidies, etc., have far from a neutral effect on our industrial structure. In all these institutional arrangements, government plays a crucial, if not decisive, role [1]. Government, working through and in alliance with "private enterprise," becomes the keystone in an edifice of neomercantilism and industrial feudalism. In the process, the institutional fabric of society is transformed from economic capitalism to political capitalism.

My hypothesis is best explained in Schumpeterian power terms. According to Schumpeter, the capitalist process was rooted, not in classical price competition, but rather "the competition from the new commodity, the new technology, the new source of supply, the new type of organization—competition which commands a decisive cost, or quality advantage and which strikes not at the margin of the profits and outputs of existing firms but at their very foundations and their very lives" [11, p. 84]. The very essence of capitalism, according to Schumpeter, was the "perennial gale of creative destruction" in which existing power positions and entrenched advantage were constantly displaced by new organizations and new power complexes. This gale of creative destruction was to be not only the harbinger of progress but also the built-in safeguard against the vices of monopoly and privilege.

What was obvious to Schumpeter and other analysts of economic power was also apparent to those who might suffer from the gales of change. They quickly and instinctively understood that storm shelters had to be built to protect themselves against this destructive force.

The mechanism which was of undoubted public benefit carried with it exorbitant private costs. And, since private storm shelters in the form of cartels and monopolies were either unlawful, unfeasible, or inadequate, they turned increasingly to government for succor and support. By manipulation of the state for private ends, the possessors of entrenched power found the most felicitous instrument for insulating themselves against, and immunizing themselves from, the Schumpeterian gale.

It requires no exaggeration to argue that modern technology and the inherent dynamism of Schumpeterian competition are such that, in the absence of governmental interference and protection, some of the bulwarks of concentrated power could be successfully eroded. Government policy toward the petroleum industry is a case in point. Under the antitrust laws, it is a per se offense for private firms to fix prices or allocate markets, yet in the name of conservation the government does for the oil companies what they could not legally do for themselves. The process is familiar. The Bureau of Mines in the Department of Interior publishes monthly estimates of the market demand for petroleum (at current prices, of course). Under the Interstate Oil Compact, approved by Congress, these estimates are broken down into quotas for each of the oil producing states which, in turn, through various prorationing devices, allocate "allowable production" to individual wells. Oil produced in violation of these prorationing regulations is branded as "hot oil," and the federal government prohibits its shipment in interstate commerce. Also, to buttress this government sanctioned cartel against potential competition, oil imports by sea are limited to slightly more than one million barrels a day. Finally, to top off these indirect subsidies with more visible favors and to provide the proper incentives for an industry crucial to the national defense, the government authorizes oil companies to charge off a 27½ percent depletion allowance against their gross income. In all, the industry has been estimated to receive special favors of $3.5 billion (according to Milton Friedman) [6] and $4.0 billion (according to Morris Aldelman) [2]—in addition to having a government sanctioned cartel provide the underpinning for its control of markets and prices.

Another case in point is the military-industrial complex, where the morganatic alliance between government and business is even clearer, bolder, and more positive. Here government not only permits and facilitates the entrenchment of private power but serves as its fountainhead. It creates and institutionalizes power concentrations which tend to breed on themselves and to defy public control. The scenario of events should be familiar. The "mad momentum" of an international weapons race militates toward large defense expenditures (currently at an annual rate of $75 billion). This generates a demand, not only for

traditional, commercial, shelf items like food, clothing, fuel, and ammunition, but also for the development and production of sophisticated weaponry. Lacking a network of government-owned arsenals, such as produced the shot and cannon in the days of American innocence, or having dismantled the arsenals it did have, the government is forced to buy what it no longer can make. It becomes a monopsonistic buyer of products which are not yet designed or for which production experience is lacking. It buys at prices for which there is little precedent and hardly any yardsticks. It deals with contractors, a large percentage of whose business is locked into supplying defense, space, or atomic energy needs. It confronts powerful oligopolists in a market where technical capability rather than price is the controlling variable—in an atmosphere shrouded by multilateral uncertainty and constant warnings about imminent aggression. In the process, government becomes almost totally dependent on the chosen instruments, i.e., creatures of its own making, for effectuating public policy [4] [8] [9]. Lacking any viable in-house capabilities, competitive yardsticks, or the potential for institutional competition, the government becomes—in the extreme—subservient to the private and special interests whose entrenched power bears the governmental seal.

This unique buyer-seller relationship, which defies analysis by conventional economic tools, lies at the root of the military-industrial complex and the new power configurations generated by it. The complex is not a conspiracy between the "merchants of death" and a band of lusty generals, but a natural coalition of interest groups with an economic, political, or professional stake in defense and space. It includes the armed services, the industrial contractors who produce for them, the labor unions that represent their workers, the lobbyists who tout their wares in the name of "free enterprise" and "national security," and the legislators who, for reasons of pork or patriotism, vote the sizable funds to underwrite the show. Every time the Congress authorizes a military appropriation, it creates a new constituency (i.e., propaganda machine) with a vested interest in its perpetuation and aggrandizement. Thus, the current proposal for an anti-ballistic-missile system, the "thin" variety of which would cost $5 billion and the "thick" variety $40 billion, and which would probably be obsolete by the time it was completed, has been estimated to involve 28 private contractors, with plants located in 42 states (i.e., 84 senators), and 172 congressional districts. Given the political reality of such situations and the economic power of the constituencies involved, there is little hope that an interaction of special interest groups will somehow cancel each other out and that there will emerge some compromise which serves the public interest. There is little assurance that the corporal's guard

of auditors in the General Accounting Office or Galbraith's scientific-professional elite or a handful of disinterested university analysts will constitute a dependable and adequate force of countervailing power. The danger remains that the "conjunction of an immense military establishment and a large arms industry," against which President Eisenhower warned, will become a Frankenstein threatening to control the contract state which brought it into being. The danger persists that power will be coalescing, not countervailing—that the political cloakroom will displace the economic market place.

It would be facile to conclude that the military-industrial complex and the new industrial state represent a price which society must pay—and inevitably so—because of national defense considerations or because of technological inexorability. But this would be to miss the point—to ignore the crucial political component in the institutional arrangements at issue. The military-industrial complex is only a special case illustrating the power problems inherent in the new industrial state. Both are created, protected, privileged, and subsidized by the state. Both represent a form of private socialism—a type of social planning through fragmented, special-interest chosen instruments operating in the "private" sector. Both represent a blending of private economic power and public political power. Both are reminiscent of the Elizabethan monopoly system and its abuse, corruption, favoritism, waste, and inefficiency—an *imperium in imperio*, without demonstrable public benefits, and without any built-in safeguards for the public interest. In sum, to the extent that they are creatures of political power and not the product of natural evolution, there is nothing inevitable about their survival and nothing inevitable about the public policies which spawn and preserve them.

II

Let us examine these public policies which lie at the base of the new industrial state, and particularly the military-industrial complex.

Defense and Space Contracts. These contracts, typically awarded on a negotiated rather than a competitive bid basis and as much the result of political as economic bargaining, convert the private contractor into a quasi-governmental, mercantilist corporation, maintained in a privileged position by "royal" franchise. The attendant abuses, especially the creation of entrenched power positions, are not inconsiderable.

In 1965, the U.S. Comptroller General, an Eisenhower appointee, highlighted the following characteristics of the contract system before a congressional committee:

(1) excessive prices in relation to available pricing information,
(2) acceptance and payment by the government for defective equipment,

(3) charges to the government for costs applicable to contractors' commercial work,
(4) contractors' use of government-owned facilities for commercial work for extended periods without payment of rent to the government,
(5) duplicate billings to the government,
(6) unreasonable or excessive costs, and
(7) excessive progress payments held by contractors without payment of interest thereon [12, p. 46].

To this list could be added the procurement of items that were not needed, or in adequate supply elsewhere in the armed services, or were in fact being sold as surplus by the buying agency; indirect procurement through the prime contractor rather than direct purchase from the actual manufacturer—at far lower prices and without the pyramiding of overhead and profits; awarding of sole-source contracts for which the contractor had no special competency; the refusal by firms with overall systems responsibility to break out components for competitive bidding, or to furnish specifications for such bidding [12] [13]; and finally, according to the Comptroller General, "excessive prices resulting from the failure of the agencies to request, or the contractors to furnish, current, accurate, and complete pricing data or from the failure to adequately evaluate such data when negotiating prices" [12, p. 46]. In quantitative terms, according to a summary of GAO studies covering the period from May, 1963, to May, 1964, there was ascertainable waste of $500 million in a 5 percent sample of procurements [9, p. 269].

Perhaps it is unavoidable that in the procurement of complicated weapons systems, where uncertainty is pervasive and precedents are unavailable, cost estimates will be unduly inflated. As Peck and Scherer found in their study of twelve major weapon system development programs, actual costs exceeded predicted costs by 3.2 times on the average, with a range of actual versus predicted costs of from 70 to 700 percent [10, pp. 19–25]. Recent prediction errors in the F-111 and Apollo programs, Scherer reports, are of the same order of magnitude.

One can sympathize with the contracting officers negotiating for complex and sophisticated weapons technology and still agree with the McClellan Committee's conclusion that the government should not abdicate its responsibilities for program management, nor delegate these responsibilities to private contractors, if it wants to avoid avoidable abuses and flagrant overcharges: "Even the most reputable and ethical contractor is placed in the conflicting position of managing a program where the feasibility, technical, and economic decisions which should be made by the customer-Government are made by the producer-contractor," the Committee observed with charitable understatement. "The absence of competition, coupled with the urgency to get the program underway, removes normal safeguards against large profits and weakens the Government's negotiating position" [16, p. 141].

On the other hand, one must understand the reluctance to endanger the national security because of excessive delays caused by punctillious bookkeeping. As Charles G. Dawes told a congressional committee investigating World War I procurement scandals:

Sure we paid. We didn't dicker. Why, man alive, we had to win the war. We would have paid horse prices for sheep if sheep could have pulled artillery to the front. Oh, it's all right now to say we bought too much vinegar and too many cold chisels, but we saved the civilization of the world. Damn it all, the business of an army is to win the war, not to quibble around with a lot of cheap buying. Hell and Maria, we weren't trying to keep a set of books, we were trying to win the war! [8, pp. 53–54.]

Government R and D and Patents. The awarding of government R and D contracts—and the disposition of patent rights thereunder—is another technique of creating, privileging, subsidizing, and entrenching private power. Again, this is a matter of man-made policy, not institutional inevitability.

The importance of federal policy in this area derives from a number of characteristics of federally financed research. Since World War II, the government has generally paid for roughly 65 percent of the nation's research and development, but performed only 15 percent of the work. Two agencies, the Department of Defense and NASA, account for about 80 percent of the government's R and D outlays. The lion's share of these outlays is concentrated in a few industries, notably aerospace, electronics, and communications. The concentration of R and D contracts is even greater than that of production contracts. There is high correlation between companies receiving R and D contracts and those receiving production contracts. Finally, the benefits of military R and D tend to spill over into civilian markets [3, pp. 71–90].

The typical R and D contract, it should be noted, is a riskless cost-plus-fixed-fee venture. It usually protects the contractor against increases in labor and materials costs; it provides him with working capital in the form of periodic progress payments; it allows him to use government plant and equipment; in addition, it guarantees him a fee up to 15 percent of the estimated cost. Nevertheless, some contractors demand additional incentives. With the arrogance characteristic of all privilege recipients, they want to extend and compound such privilege. "We recognize," says the vice-president of the Electronics Industries Association, a prime beneficiary of government-financed R and D, "that the ownership of a patent is a valuable property right entitled to protection against seizure by the Government without just compensation" [17, p. 132]. In this view, the patent is a right, not a privilege voluntarily bestowed by the government to effectuate a public purpose. By a curious perversion of logic, it becomes a vested privilege to which the private contractor is entitled and of which he is not supposed to be deprived without "just" compensation.

Characteristically, both the Department of Defense and NASA have accepted this argument for privilege creation and made it the corner-stone of their patent policies. The principle at issue requires little adumbration. Allowing a contractor to retain patents on research fi-nanced by and performed for the government, as Wassily Leontief points out, "is no more reasonable or economically sound than to bestow on contractors, who build a road financed by public funds, the right to collect tolls from the cars that will eventually use it" [17, p. 234]—or the right to close the road altogether. It is tantamount to socializing the financial support for research while permitting private monopolization of its benefits. Moreover, as Admiral Rickover ob-served, firms receiving R and D contracts "are relatively few huge cor-porate entities already possessing great concentrated economic power. They are not ailing segments of the economy in need of public aid or subsidy. Nor are there any real reasons to offer patent give-aways in order to induce them to accept Defense Department research grants or contracts. . . . To claim that agencies cannot get firms to sign such contracts unless patent rights are given away strikes me as fanciful nonsense" [9, p. 294].

Stockpiling of Strategic and Critical Materials. This is an "ever normal granary" program, ostensibly designed to enable the United States to fight a war of specified duration, determined by the strategic assump-tions of the Joint Chiefs of Staff. In reality, it is a price support program, the details of which are buried in secret government files and the "primary purpose" of which is to subsidize selected mining interests in the name of national security [14, p. 36–45]. That, at least, was the conclusion of the exhaustive hearings conducted by the Symington Subcommittee of the Senate Armed Services Committee which ex-amined the origin and growth of the national stockpile, the Defense Production Act inventory, and supplemental stockpile, which by 1961 had involved the expenditure $8.9 billion [14, p. 4].

These were the specific findings of the Symington Subcommittee:

1. Stockpile objectives were constantly manipulated to increase purchases regardless of national security needs. Thus, starting in 1954, "to justify further purchases of lead and zinc, when use of the old formula or requirements versus supplies did not permit additional buying, basic strategic assumptions were changed, and two objectives for each material were established. Under this new concept, the basic objective was determined under the usual method, but a new objec-tive—the maximum objective—was arrived at by disallowing all sup-plies of a material from overseas. This had the effect, in many instances, of doubling the amount of a material that had to be stockpiled. It was then discovered, however, that even this new system would not permit

additional purchases of lead and zinc in the amounts needed to maintain higher prices for lead and zinc. Resort was then had to the arbitrary one-year rule. Under this rule objectives were set at one year's consumption of the total national economy during a normal year without regard to what our requirements and supplies were" [14, pp. 4–5]. In the case of some ores and minerals, an arbitrary six-month rule was adopted.

2. The buying programs to develop a domestic supply of certain ores, said the Committee, "can only be described as a failure. . . . Much of the material purchased was not needed. A substantial part of these ores did not meet the specifications of the stockpile. Nor was any domestic mobilization base established by these purchases as is indicated by the fact that when the purchases stopped production stopped as well" [14, pp. 8–9, 66]. Moreover, contrary to expectations, most of the expenditures did not go to small business but to well-established mining companies; 86.7 percent of the tungsten purchases, for example, were made from the ten largest producers.

3. The price support level of some materials, like tungsten, e.g., were set two or three times above world prices, thus allowing the contractors windfall profits by buying at low world prices and supplying the stockpile at artificially exorbitant prices [14, pp. 69–71].

4. Premium prices were often paid to contractors on the assumption that it would be necessary for the contractor to incur substantial capital expenditures to perform under the contract. Yet the government was denied the right under these contracts to check whether the capital expenditures had in fact been made, or to inspect the contractor's book to ascertain his production costs, or to renegotiate the price if the anticipated high costs were not realized [14, pp. 68–69].

5. When market prices for some materials, like copper, e.g., rose above the contractual stockpile price, producers were permitted to divert deliveries from the stockpile to private industry—without sharing this windfall with the government [14, pp. 49–54].

6. When the Joint Chiefs of Staff changed their strategic assumptions from a five-year war to a three-year war, the stockpile administrators waited for two years before implementing the change. Felix Wormser, Assistant Secretary of the Interior for Minerals Resources, who before and after his government service was vice-president of the nation's largest lead producer (St. Joseph Lead Co.), protested that such a change would constitute "a breach of faith with the mining industry" [14, p. 25].

7. Disposals of excess supplies were resisted strenuously, and only in tin and rubber were any large-scale sales made. "It is significant," the Symington Committee noted wryly, "that there are no producers of natural rubber and tin in the United States and this could well account

for the fact that the only two large disposals have been in these materials" [14, p. 28].

The point need not be belabored. The rules for operating the national stockpiles as articulated by the industries concerned and their protagonists in government are fairly simple: The government must accumulate reserves against the most unthinkable eventualities. It must buy these materials at prices industry considers remunerative, regardless of world market conditions. This subsidy must be adequate to enable industry to operate profitably until such time as its services are required for mobilization in time of war. Finally, regardless of the available stocks, no disposal must ever be made from the stockpile. Such sales would not only endanger national security but also disturb market conditions and hence constitute unwarranted government interference with free enterprise.

Alienation of the Public Domain. To achieve or solidify their control over prices and markets, the giants of American industry cannot rely on the imperatives of modern technology. On the contrary, they must live in constant fear of the "creative destruction" wrought by new technology; and they must always be alert to the potential competition of substitute products and processes. Even more important, they must fight to contain, neutralize, and sterilize the "institutional" competition of the public domain which threatens to impose an intolerable regulatory yardstick on their operations. TVA is an embarrassment to the electric power monopoly, the communication satellite to AT&T dominance, navy shipyards to the shipbuilding cartel, and the Army's Redstone Arsenal and Jet Propulsion Laboratory to the condottieri of aerospace. Pressure must be exerted, therefore, to dismantle such operations, or to circumscribe their competitive viability, or to sell their facilities to private enterprise—in a manner which does not disturb the existing power structure and indeed might even entrench it more solidly. Here, again, governmental cooperation is required for implementation of this grand strategy, and this is a matter of political decision, not technological or economic inevitability.

The disposal of government-owned plants at the end of World War II underscores the nature of the power struggle and the availability of public policy alternatives [1, pp. 117–41]. In aluminum, the disposal program was a qualified success; Alcoa's prewar monopoly was broken, Kaiser and Reynolds sprung like Minerva from Jupiter's brow, and the aluminum industry was converted into a triopoly. Synthetic nitrogen production was also deconcentrated by the infusion of additional sellers. In steel, by contrast, the disposal program served to entrench and extend oligopoly dominance; the Geneva Steel plant, built at a cost of $202.4 million, was sold to the United States Steel Corporation for

$47.5 million, and enabled U.S. Steel to increase its regional control over the Pacific Coast and Mountain States market from 17.3 to a commanding 39 percent. In synthetic rubber, the wartime operation of the government plants gave a handful of large firms enormous patent and know-how advantages for the postwar period, and the subsequent disposal program resulted in the sale of twenty-five plants to three firms controlling 47 percent of the industry's capacity.

More recent is the controversy over the disposition of the government's oil shale lands, located in the Rocky Mountain States, and estimated to contain two trillion barrels of oil (i.e., six times the known oil reserves of the entire world) [19, pp. 106–07]. It illustrates the public policy options which are available to influence the structure of markets and to cope with existing power concentrations. At issue are the ground rules to be established for the control and development of a resource valued at $2.5 to $3.5 trillion [19, pp. 403, 407].

The petroleum industry's plan, according to one of its spokesmen, is to create "an economic climate equivalent to that provided [for] crude oil." Under its plan, the oil companies would be allowed to carve out homestead-like leases from the public lands and would be eligible for the customary subsidy of $27\frac{1}{2}$ depletion allowance in return for their development efforts. Shell Oil has already proposed to lease a "homestead" that would cover its refining requirements (at present rates) for the next 660 years; Sinclair has entered its more modest request for a tract that would fill its needs for 226 years; Humble's request would provide for the next 54 years; and Continental's for the next 27 years [19, p. 455]. The desire to gain control of a potentially competitive resource is not coupled with any guarantee to produce from it; and if production should take place, it would be subject to the oligopolistic rationality of the oil majors, restrained from undue competitiveness by government proration regulations.

Opponents of this plan, notably John K. Galbraith, argue that this "would be a free ride to monopoly for the big companies. Unless safeguards . . . are carefully spelled out what would happen is that few of the majors would get these reserves as their reward. An eventual position in the basins would be their payoff. This would be in addition to the lands that they already own in most cases. Were there development, the processes for recovering the shale would then presumably be patented by them and reserved to them" [19, p. 22]. Obviously there are policy alternatives, including *inter alia* TVA- and COMSAT-like arrangements. "Certainly," as Senator Hart, chairman of the Senate Antitrust Subcommittee put it, "the development of oil shale reserves should offer a unique opportunity for new sources of competition to

penetrate the petroleum industry. And that opportunity depends substantially on Government policy" [19, p. 3].

International Trade Barriers. No system based on protection, privilege, and subsidy is safe without barriers to foreign competition. Its beneficiaries recognize the rough validity of the Mancunian assumption that "free international trade is the best antimonopoly policy and the best guarantee for the maintenance of a healthy degree of free competition." Action is, therefore, necessary to protect domestic restrictionism against erosion and subversion from abroad. And governmental action is the most reliable technique available.

The steel industry, in its current clamor for tariffs and/or quotas, illustrates the rationale of (what *Barron's* calls) the "protection racket" (Oct. 18, 1967). Roger Blough, congenitally unable to resist the ludicrous, observes that "obviously there are many things in life that should and must be protected. For example, millions of our people—and a number of government agencies—are laudably striving to protect certain vanishing forms of wildlife that are threatened with extinction; and one may reasonably wonder, I suppose, how far down the road to oblivion some of our major industries must go before they are deemed to merit similar concern" [5]. To this, the president of the American Iron & Steel Institutes adds the ominous warning that "a first-class power with global responsibilities cannot afford to rely for any important part of its needs on overseas sources of steel thousands of miles away. There is the constant danger that these sources may be cut off at a critical moment" [15, p. 830]. Finally, the United Steel Workers of America, upon whom Galbraith once relied as a source of countervailing power, and not to be outdone in their concern for the public interest and national security, lend their voice and not inconsiderable political influence to the fight for a quota law to limit steel imports [15, pp. 888–96].

What is at stake, of course, is the steel industry's right to preserve its administered price structure, to remain the catalyst of seller's inflation, to impose periodic price squeezes on independent fabricators, to price itself out of world export markets, to encourage the growth of substitute materials, and to persist in its technological lethargy [15, pp. 846–88]. Specifically, the industry needs government help to validate its investment in "40 million tons of the wrong capacity—the open hearth furnace" which it built in the 1950's. This capacity, as *Fortune* points out, was "obsolete when it was built" and the industry by installing it "prepared itself for dying" [15, p. 855]. This is the $800 million blunder, the cost of which the industry would like to shift to the public by obtaining government protection from foreign competition.

The point need not be stressed. Tariffs, quotas, "anti-dumping" statutes, "Buy American" regulations, and similar devices are not only a tax on domestic consumers and a subsidy to sheltered industries, but the capstone of any policy to protect entrenched economic power. They are a crucial facet of the *Realpolitik* designed to preserve the discipline of a nation's *Ordnungswirtschaft*.

III

In conclusion, we may note that the problem at hand is not one of technological determinism which would militate toward fatalistic acceptance of the *status quo*. Nor is it rooted in the ineffectiveness of what Galbraith calls the charade of antitrust. Instead, it is largely a political problem of governmental creation, protection, and subsidization of private privilege. If this diagnosis is indeed correct, then public policy alternatives are available and a reasonably competitive market is more than a utopian policy objective.

Let me offer two general policy recommendations:

1. Most important is government noninterference in markets which in the absence of such interference would be workably competitive. In the words of Adam Smith, it may be difficult to "prevent people of the same trade from sometimes assembling together," but government "ought to do nothing to facilitate such assemblies; much less to render them necessary." While assuring effective enforcement of the antitrust laws, government should abjure the role of the mercantilist state in sanctioning and legitimizing private privilege. One can only speculate on the quantitative benefits of such measures as the abolition of tariffs in concentrated industries, the deregulation of surface transportation from ICC control, or the elimination of the honeycomb of governmental supports for the petroleum price and power structure.

2. In those areas where competition cannot be allowed full sway or where government cannot avoid active participation in the economic game, the basic guidelines point to preserving the maximum amount of power decentralization feasible. This may require positive encouragement of institutional competition from whatever source available and, at the very least, the preservation of effective yardsticks by which to measure and control monopoly performance. In the national defense sector, for example, government must rebuild and preserve its in-house competence for R and D, systems engineering and management, and contract evaluation. As the Bell Report of 1962 concluded, "there are certain [management] functions which should under no circumstances be contracted out" [4, p. 213]. Basic policy and program decisions respecting the research and development effort—relating to "the types of work to be undertaken, when, by whom, and at what cost—must be

made by full-time Government officials. Such officials must also be able to supervise the execution of work undertaken, and to evaluate the results" [4, pp. 214–15]. In short, the government cannot surrender the yardsticks essential for the discharge of its responsibilities to the public [9, pp. 334–50]. And the public must recognize that the servants of the military-industrial state cannot be allowed to become its masters— either in the name of "free enterprise" or under the guise of promoting the "national security."

What I have said here is not likely to please those who rationalize the *status quo* by invoking some deterministic inevitability. I do not claim that what I have said is particularly new or startling. I do believe, however, that it is true and that, as Dr. Johnson said, men need not so much to be informed as reminded.

REFERENCES

1. Walter Adams and Horace M. Gray, *Monopoly in America: The Government as Promoter* (New York, 1955).
2. Morris A. Adelman, "Efficiency of Resource Use in Crude Petroleum: Abstract," *A.E.R.*, May, 1964.
3. Richard J. Barber, *The Politics of Research* (Washington, 1966).
4. David E. Bell, "Report to the President on Government R&D Contracting," Apr., 1962, printed in House Committee on Government Operations, *Systems Development and Management, Hearings*, Part 1, Appendix I, 87th Cong., 2d Sess., 1962, pp. 191–337.
5. Roger M. Blough, "Progress Is Not Our Most Imported Product," Address at the Annual Meeting of the Indiana Manufactures Association, Indianapolis, Nov. 16, 1967.
6. Milton Friedman, "Oil and the Middle East," *Newsweek*, June 26, 1967.
7. John K. Galbraith, *The New Industrial State* (Boston, 1967).
8. Clark R. Mollenhoff, *The Pentagon* (New York, 1967).
9. H. L. Nieburg, *In the Name of Science* (Chicago, 1966).
10. Merton J. Peck and Frederic M. Scherer, *The Weapons Acquisition Process: An Economic Analysis* (Harvard Bus. Sch. Div. of Res., 1962).
11. Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy* (New York, 1942).
12. U. S. House, Committee on Government Operations, *Comptroller General Reports to Congress on Audits of Defense Contracts, Hearings*, 89th Cong., 1st Sess., 1965.
13. U. S. Joint Economic Committee, *Background Materials on Economic Impact of Federal Procurement*, Washington, various years 1964–67; appendices contain lists and digests of General Accounting Office reports on defense activities to Congress.
14. U. S. Senate Committee on Armed Services, Draft Report of the National Stockpile and Naval Petroleum Reserves Subcommittee, *Inquiry into the Strategic and Critical Material Stockpiles of the United States*, 88th Cong., 1st Sess., 1963.
15. U. S. Senate Committee on Finance, *Import Quota Legislation, Hearings*, Part 2, 90th Cong., 1st Sess., 1967.
16. U. S. Senate Committee on Government Operations, *Pyramiding of Profits and Costs in the Missile Procurement Program, Report No. 970*, 88th Cong., 2d Sess., 1964.
17. U. S. Senate Select Committee on Small Business, *Economic Aspects of Government Patent Policies, Hearings*, 88th Cong., 1st Sess., 1963.
18. U. S. Senate Select Committee on Small Business, *Planning, Regulation, and Competition, Hearings*, 90th Cong., 1st Sess., 1967.
19. U. S. Senate Subcommittee on Antitrust and Monopoly, *Competitive Aspects of Oil Shale Development, Hearings*, Part 1, 90th Cong., 1st Sess., 1967.
20. U. S. Senate Subcommittee on Antitrust and Monopoly, *Economic Concentration, Hearings*, Parts 3 and 6, Washington, 1965 and 1967.

SOCIAL CONTROL OF INNOVATION

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In the decade ahead, R and D programs will be a battleground of public attention, anxiety, and trouble. The scientist, engineer, systems manager, and industrialist will be embroiled as never before in politics. Outsiders, reformers, and new pressure groups will play an increasing role, and the technical specialists, in outraged impotence, will sputter that if only they were left alone, they could solve every problem.

There are many signs of trouble. A number of congressmen are calling for the "assessment of technology"; the nation remains uncommitted to large undertakings beyond Apollo; the arms race resumes with ABM and multiple warheads; guerilla warfare in Vietnam and in city streets dominates the budget; the Bureau of the Budget tightens R and D scrutiny, more centralized agencies are created for transportation, environmental services, oceanography, and communications.

The trouble is reflected in recent trends of contracting, in the new forms and institutions for negotiating, monitoring, and evaluating R and D performance.

The question, what are the social and political implications of R and D, is now emerging as the next great debate of our time. Those who paint a glowing picture of the 1970's, of the magnificent opportunities around the corner, are destined for disappointment. Instead, the R and D establishment faces a period of retrenchment and skepticism.

The problem of controlling technology is part of the larger problem raised by the specter of impersonal and arbitrary power in an integrated and planned social order. My statement here is motivated by faith that correctives are still available, that authority can be humanized, and that the permanent revolution of science and technology need not undermine the basis of a free society. Science and technology have an honest and honorable place, but it is a limited place, rationed in accordance with responsible interest group activity and a pluralistic definition of the national interest. As such there is no escape from politics and no substitute.

All the efforts of the last decade to reform the R and D contract instrument have aimed at controlling conflicts of interest, waste and profit, noncompetitive and sole-source procurement, etc. The substitution of incentive fees for fixed fees, the improvement of contract management and internal auditing, efforts at hardware second-sourcing, etc.—such methods have aimed to give government better information

and control. However, the best one can say, such reforms eliminated some overlapping but failed to draw even a clear line between government and the new quasi-public utilities of the aerospace industry. When the DOD admits (as it did last year) it had no inventory of government property which is in contractor hands and is not interested in getting one, it is symbolic of the breakdown of traditional boundaries between what is public and what is private. Prime contractors, systems managers, integration engineers and nonprofit brain trusters have merged to become integral parts of government. MacNamara's efforts to adopt "total package" procurement (R and D through hardware) in order to introduce a competitive phase in contract negotiations may hike the saving reported by the cost reduction program but it also further obscures and buries contractor performance and bookkeeping, and the government does not escape ultimate responsibility for the contractor's economic health.

The mingling of contractor and civil service personnel, the frequent transfer of personnel between government and contractors, the role of contractors as advisers to contracting agencies, the place of congressmen as mediators and salesmen for companies that provide jobs in their districts, the inability of the MacNamara regime to enforce the "Truth in Negotiation Law" in spite of Herculean effort, the continuous friction between the General Accounting Office and the DOD, as well as between both and the contractors—all reinforce the conclusion that not only is the contractor in the hands of government but the government is equally in the hands of the contractor.

DOD and NASA argue that incentive fee contracts eventually provide a real cost basis, but the fact persists that the fee schedule buffers the contractor against his own mistakes and those of the contracting agency. North American Aviation made a profit of almost 7 percent on the contract for developing and testing the Apollo 204 spacecraft. (They received $41 million in profit on a $600 million contract; if the disaster had not occurred, the incentive fee would have been $56 million.) The Army gets in trouble with the House Armed Services subcommittee because it suggested that a favored contractor subsidize the initial purchase of helicopters and make up the difference in subsequent reorders. The Army's mistake was to make the suggestion a matter of record; since it has become a familiar practise of the military branches to evade some of the MacNamara reforms, aiding a company in formulating a "competitive" bid which will guarantee selection. The case of the F-111 is instructive in the same regard. MacNamara wanted "commonality" in the aircraft between service requirements in order to save R and D funds. General Dynamics and the Navy played the game and won; Boeing made the mistake of tailoring its design and

cost estimates as part of an Air Force ploy to defeat commonality in order to preserve Air Force source selection authority. The Panel on Science and Technology of the House Science and Astronautics Committee follows its hearings with a gala reception at a local hotel for the distinguished panel. The tab for the affair is picked up by North American Aviation.

All of these instances demonstrate, not cupidity and impropriety, but rather the blending of government and contractor into an integral whole where traditional conflict-of-interest doctrine is archaic and unenforceable. The result is a system which does not accord with our theories and which uses the old slogans of free enterprise to put large segments of quasi-government beyond democratic scrutiny. It brings an incestuous layering of private bureaucracy; it blunts attempts at frugal management and rewards inadequate performance and errors with new contracts to cover overrun costs or to repair defects. In the words of Don Price, the relationship between government and its R and D contractors is "more like the administrative relationship between an industrial corporation and its subsidiary than the traditional relationship of buyer and seller in a free market." Certainly, scientists, soldiers, and industrialists are not less honest than other men; but they are not more honest either, and the twilight world of accountability brought about by R and D contracting does not enforce a rigid code of ethics.

The government contract, improvised, *ad hoc*, and largely unexamined, has become an increasingly important device for intervention in public affairs, not only to procure goods and services, but to achieve a variety of policy ends—allocating national resources, organizing human efforts, stimulating economic activity, and distributing status and power. The government contract has achieved in two decades a scope and magnitude that rivals simple subsidies, tariffs, taxes, direct regulation, and positive action programs in their impact upon the American life.

Just as federal grants-in-aid to state and local governments have (since 1933) become principal means for national integration of divided local jurisdictions, so federal contracting with private corporations is creating a new kind of economic federalism. Favored corporations that win R and D work thereafter exploit a number of special advantages: they may achieve sole-source or prime contractor status, which eliminates competition, dilutes cost and performance evaluation, and enables the R and D performers to become powerful industrial brokers using unlimited taxpayer funds and contract awards to strengthen their corporate position, cartelize the contract market, and exert political influence.

Technological change and world politics have broken down the

reliable old dichotomies. War and peace are no longer distinguishable conditions of international relations; what is private and what is public activity, rights, and property are hopelessly ambiguous, not only in government hardware procurement and R and D contracting or in such new creatures as Comsat Corporation, but also in almost every facet of our national life; as we move toward concentrated economic functions and big government the line fades between economic and political decision making whether by corporate management or by government agencies.

Because of its peculiar and unique ambiguity, R and D has tended to become a central factor in transforming our social and political institutions in ways still dimly perceived. It is something of a cliché to speak of science and technology as frontiers of social as well as technical change; yet it is exactly the reality of what is happening. For government R and D has become a new tool, not merely for carrying out avowed and politically defined public tasks, but also for social and economic management of our national life. For the performer, R and D is not only a means of providing goods and services to government but also the secret of corporate survival and growth as well as the mainstay of community employment and prosperity.

The aerospace industry is the major repository of advanced technology, because defense and space innovation have for twenty years been the dominating factor in the organization of industrial life. These industries claim a proprietary control of most of the nation's systems capabilities. As spending for strategic weapons systems and space at last begin to inch downward ($40 billion for aerospace contracts in 1968), as domestic problems sharpen, the aerospace companies are making this special capability available for the operation of Job Corps Camps, management and planning of poverty programs, fighting crime, desalination of water, oceanography, waste management, urban transportation. This confronts us with a curious paradox. As public facilities and domestic needs at last begin to receive official attention, the quasi-public utilities are moving into every area, including traditional ones where civil servants of municipal, state, and national agencies or not-for-profit universities formerly did the job. Here, too, every problem is defined as R and D and claimed as a special province for the systems capability of large corporations. A paradox lies in the fact that the ideology of these enterprises, faith in the infallibility of science, is directly contrary to the trend in science itself and in most social philosophy. The tide of opinion among philosophers has come to question the very position now assumed by those with more concrete political and financial stakes in science and technology.

The science-technology race seems headed toward a *reductio ad*

absurdem in which the rate of innovation itself creates the most severe problems of reliability and overrun costs. Needless complication both technically and administratively leads to escalated confusion and enactment of Parkinson's law. We run faster and faster barely to manage to stay where we are; build elaborate automated pyramids of systems analysis with systems managers and engineers coordinating and managing systems managers and engineers, a daily saga that rivals for dramatic imagery and noise the Napoleonic campaign in Russia. All seems to be well until an event like the incineration of three Apollo astronauts shockingly disrupts the facade.

Brain factories, future planners, science facilities, laboratories—the single-minded concentration upon innovation has swept the nation in what an editor of *Fortune* calls "the greatest advance in the art of government in nearly a hundred years." Great Society plans have become a commonplace power play by university professors seeking grants and industrialists seeking contracts in a nation which ideologically rejects planning and continues to plan indirectly through federal subsidies, grants-in-aid, procurement contracting, and other backhanded methods. The systems-analysts and operations-researchers constitute these "brain storm" troopers of the futuribles who are sweeping away the fragmented "cut and try" institutions of the past.

More and more public tasks these days are defined as R and D. The meaning of this is plain. It is the trend toward rationalized control of every aspect of economic activity. When Litton Industries begins to build ore carriers, Ling Temco Vaughn tennis rackets, and Aerojet General offers to manage California's traffic control problems, what is happening? The new rationalized giants are going into new fields previously organized in smaller units. By defining every problem as an R and D problem and insisting upon a systems approach we are in effect pursuing the logical culmination of highly centralized operations and planning made possible by computers and by our capability to design technology to do anything we want to do.

Pre-World War II work order type contracts for the procurement of services from the private sector are disappearing. Job specifications by government agencies become more and more open-ended, so that more and more activities get thrown into the R and D hopper. More and more R and D contracting puts government in the hands of private companies. Increasing dependence by private companies on such contracts forces them into insider politics in order to maximize and stabilize their market. One of the chief reasons for R and D growth is this mutual exploitation of need by government and contractor.

The R and D contract (on cost-plus basis) maintains the government's commitment to company survival as a national security re-

source. The government contract steadily replaces commercial market incentives. This new partnership becomes the essential way of life to all participants, maintaining the level of regional employment and prosperity, and avoiding general recession. While aerospace and defense work has converted large segments of American industry into public utilities, that status is still largely immune from adequate public control and represents a fundamental ambiguity which blends private and public interests inseparably.

Simple invention of new contractual techniques without regard to the changing role of R and D offers little promise. In a real sense national coordination and policy making have integrated every aspect of economic life, a trend which also threatens other areas of private action. Political relationships have replaced the impersonal fluctuations of supply and demand and the political forum has overwhelmed the role of individual initiative; group bargaining and pressure politics have largely replaced private bargaining and contract.

The old dichotomy between what is private and what is public is in the process of abandonment; but an explicit rubric which will protect democracy and the public interest has not been formulated. What must come is a system of values and institutions which will replace economic initiative and private property as guarantors of political independence and pluralism. This task of formulation is the greatest challenge of the future. As economic pluralism disappears, only political pluralism, safeguarded by new institutions of representation, can make the exercise of power both responsive and limited. A heightened and more representative infrastructure of interest groups is necessary at all levels of society and may already be forming. The weakness of such interest groups in the past may have contributed to the use of R and D contracting as a form of indirect government intervention in the economy. The problem is not as so many critics of the establishment believe, to control technology; rather it is to control those interest groups and power coalitions who are—in the name of an automatic impersonal urge toward technological change—making public policy for the nation and holding in their hand much of the power of decision making for the whole society.

Man does not simply innovate what he can, and inventions are not mainly knowledge induced. The existing state of the art is merely a condition which limits the potential of future choice. But the process of choice itself is preeminent. Innovative activity is dominated by external factors, by the perception of problems and opportunities, by the allocation of resources, by a social process. There is uncertainty in all policy choice and in all assessment of social and economic values. This is not limited to open-ended R and D. Allocations for R and D are like all

allocations of values in policy making; they are made in spite of uncertainty and in spite of conflicting assessments of social and economic values. What may appear to be an automatic process is in fact a process of choice in which some do not participate and from which some may be deliberately excluded. We must strive to include all the trouble making pressure groups we can find. We won't have to look hard. The trouble-makers are finding themselves. In such an atmosphere, specialists in mediating group conflicts, the practical politicians, find their glory, and the informed observer, critic, and theoretician, the political scientist, has his day.

Doing R and D on anything implies dissatisfaction with the existing means of dealing with a situation or solving a problem. The implication is that someone is dissatisfied and the question that should be asked is who and what—the immemorial and key questions of political inquiry. Who demands R and D for a supersonic commercial transport? The pressure group incentives at work are complicated and are frequently couched in terms of "the search for knowledge" and "the inevitability of progress." There are no such abstract issues in politics; only "who gets what, when, and how." Every energetic pressure group in the United States tried to capitalize on the 1957 Soviet Sputnik triumph and the alarmist space gap. Educators, scientists, industry, the military —all urged the importance of the space age, but agreed on little else. Strangely, each of them offered to the nation a formula which best served its own narrow interests.

When a technologist informs Congress it is now "technically feasible" to accomplish some task, the hard questions fly thick and fast: Technically feasible relative to what? What are all the options for dealing with the problem? The standards of judgment are the old familiar ones: How much good will it do, for whom, at what cost? What are the alternatives? How much political power do those have who favor or oppose? How does action on this problem relate to the priorities of competing problems? Faith in science is no longer an irresistible talisman for persuading public policy to endorse any and every proposal. The political scientist knows that every policy act has many and diverse motives behind it; that the practical politicians who mediate group conflict are frequently more interested in "who favors what" than in what is favored.

Both liberals and conservatives are stuck with increasingly irrelevant and meaningless slogans that ignore the real issues of monitoring the partnership between government and industry, of reforming the gravitation of policy making to the private government of industrial organizations whose internal processes are still beyond the pale of the Constitution; of humanizing national life by applying the Bill of Rights to

individuals in private as well as public organizations. The categories of old ideologies have no place for the concepts of the "new economics," the problem of allocating "full employment surplus," the need to introduce full and representative pressure group participation in the forms of scientific and technical advice and policy making. The strictures of old value systems cannot comprehend "nationalization" by government contract—by indirect subsidies, by fiscal management and pump priming.

We are already in the process of creating more control at the top with the creation of a Department of Transportation and the advocacy of a Department of Communications, the reorganization of environmental services, and oceanographic research. The enhanced role of the Bureau of the Budget in seeking to force visibility at the top moves in the right direction. The Budget Bureau and the Office of Science and Technology can work toward broad R and D programs throughout government in advance of the formulation of agency budgets by means of a crosscutting overview.

These areas can only be related to each other and to the overall structure of priorities on the basis of values and policy. Allocations do not occur in the abstract but are the result of the process of pressure group politics. The solution is not to eliminate pressure but to increase it by ascertaining that every relevant interest group is represented in early stages of policy making and the resulting compromises represent an optimal consensus of the largest possible number as well as a vision of the future on the part of political leaders.

What is required at the top is an integrated plan. Not a grand design or a controlled economy, but rather a set of balanced priorities and long-range goals that can direct private and public bodies, coordinate separate initiatives, and minimize the objectionable *ad hoc* interventions forced upon government by the present system of disguised and back-handed planning through the Council of Economic Advisers, fiscal policy, contract awards, presidential pressure in labor disputes and in pricing decisions, etc. Government planning can be based on indirect incentives rather than detailed compulsory direction from above. Such planning must insofar as possible be democratized by interest group participation at every level of policy and execution. We are moving towards this kind of planning in the new approach of the problems of slum housing and water and air pollution, but we have a long way to go.

R and D as back-handed pump priming must end. The maintenance of prosperity by pumping wages and salaries to maintain aggregate demand is counterproductive when focused upon technical innovation. The effect is to increase the rate of automation and provide incentives for industry to substitute capital for labor costs, thereby shrinking ag-

gregate demand and intensifying the original problem. In addition, apart from the temporary corrective of Vietnam war spending, automation and a high rate of technological innovation are increasing the rigidity of social class, eliminating jobs which a static economy does not quickly provide. It is not enough anymore to maintain aggregate demand by continuous improvisations whether in the form of R and D, tax cuts, or crisis spending. What is needed is steady and sustainable growth accomplished by an increase in selective demand. R and D as pump priming must give way to frank recognition of other social priorities and problems. A kind of input-output analysis for the economy as a whole, such as the Council of Economic Advisers now provides but which is more representative and capable of creating an expert consensus, is required. Perhaps a national planning agency should be formalized.

There are many pressing tasks for the future: how to get more hospital beds, more doctors, meaningful jobs for the underskilled, more adequate social security benefits, and so on. It is easy to make a list of things worth doing. The problem is collating and implementing them through the political process.

The reality principle of R and D futuribles can be stated in terms of comparative costs. How much innovation can we afford? The convenience and cost saving of each innovation must exceed the loss of existing capital investment. This is a difficult yardstick to apply. There is no substitute for the political process and the zigzags of leadership and choice.

The modern industrial state generates most of its productive power from mass production and frozen designs, production lines, and machinery. Innovation, however, constantly challenges these savings with the sometimes elusive promise of greater saving and greater conveniences. There is therefore an inherent contradiction between industrial production and technological innovation. Some industries have suffered from leaning too long on old methods and equipment; other industries, those favored by government subsidy, may suffer equally from extreme innovation which tends to neglect cost comparison and makes change an end in itself. Somewhere between frozen production lines and innovation a line must be drawn. This cannot be done in an abstract way but must be applied to specific and concrete cases. Major programs once started are difficult to shut off. New programs that do not come with a built-in powerful interest group are difficult to sell to Congress.

On the part of private industry, the major performer of R and D, the partnership with government requires some kind of formalization which vouchsafes the role of interest group representatives in corporate decision making whether by the appointment of public members to boards of directors or by establishing review boards over price adjustments and production decisions.

Some kind of partnership between private enterprise and government is desirable and inevitable. Government responsibilities are too broad and manifold to be conducted entirely by civil servants in a vast bureaucracy. The pluralism provided by the private economy—at least in those areas where the profit motive and competition still operate—still provides a yardstick and should be preserved.

R and D contract instruments of the 1970's will continue the trend of experimentation and novelty. The basic rule of administration, like science itself, its trial and error. Every task and every government agency will doubtless experiment with variations and improvements. There is no magical document or technique to fit all tasks and all agencies. When R and D ceases to be a substitute form of pump priming, a special interest myth of legitimacy, a tool of government or corporation aggrandizement, the problem of finding the right contract forms will be much easier than it is today.

The DOD's new Central Audit Agency can do an important part of the job which the GAO heretofore has performed. The DOD recently promised Senator Proxmire that the DCAA will soon undertake post-award audits. This will be difficult to apply to R and D work but should be done nevertheless. But the DCAA is neither government-wide nor independent of the Defense Department. After MacNamara, its role may be drastically altered. To government-wide agencies, Bureau of the Budget and General Accounting Office, can make an invaluable contribution. The former has only incidental post-audit responsibilities, and of course lacks independence from the ongoing interests of the Administration. The role of GAO is indispensable to provide Congress and the public with information on government expenditures from a source independent of the Executive and of the agencies of the vast federal establishment. Its "Inspector General" function should be protected from the vicissitudes of politics and from inordinate control by any parochial agency, congressional bloc, or transitory aberration of public opinion. The Inspector General requires a legal basis of independence similar to that of federal judges. The contract-auditing function can work exactly as does the GAO at its best. The GAO staff must enjoy secure civil service status, adequate salaries, high standards, and the prestige which appointment of a respected senior statesman, industrialist, labor leader, or other distinguished professional to the top post might induce. Full public disclosure of all audit investigations must be guaranteed.

In the ever larger areas where government is the sole customer, where there is no civilian market for comparison, or where quasi-monopoly and administered prices prevail, the government must create and conserve a yardstick of its own. For example, in the area of road building, both federal and state governments can maintain a full complement of road-

building crews in the status of civil servants, reserving samples of high-way construction projects in selected areas of the nation for "in-house" pricing purposes. Similarly, in defense, space, and science, we must halt the decline of real in-house capabilities and must maintain government arsenals, navy yard shipbuilding programs, university administered laboratories and testing facilities, federal laboratories and factories. For R and D, the only means of quality control available is high quality in-house and university research both for comparison and for providing a pool of qualified and independent public R and D administrators.

Last year, the DOD required that generals, admirals, and top-level civilian employees disclose all their financial holdings and outside employment. In addition, lower ranking civilians and officers must file such statements if their duties involve procurement or contracting. This conflicts with traditional standards of privacy but when coupled with an upgrading of career government employees in salary, advancement opportunity, and assignment of authentically important and challenging work, it may be a minimal step. And it is not too farfetched to liken the position of major government contractors to that of career officers and civil servants and to require of them a similar disclosure. Access to books and records of corporations engaged in government work of an annual value above, let us say, $100,000 might go far toward changing the name of the game. We must think hard of new institutions for fund-ing R and D—perhaps public foundations or new public corporations. A national R and D revolving fund under independent national boards (such as exists in some European countries) might support many kinds of R and D in the civilian economy. A kind of NSF for applied R and D work should be considered by Congress. Or possibly a CIA for R and D?

Something might be done also to organize bodies of citizens representing functional groups, skill groups, and interest groups that have a direct concern with some aspect of activities undertaken by government and its contractors. Such citizen groups might be given an advisory role similar to that which Sargent Shriver has sought for the poor in the management of poverty programs.

Our theme is the need to assimilate the mysteries of science and technology to ordinary political analysis, commonsense political judgment, and plain English. Obviously the nation cannot deny itself the aid of augmented science and technology in facing the serious problems of the day. But neither can it blindly accept all those claims made in the name of science and technology as inexorable natural forces. Scientific and technical change are far from unstoppable and automatic but are rather the result of and responsive to public policy. The interested public can gain access and predict consequences in this at least as well as in any area of policy choice; and all areas today are complicated, highly specialized, and jargonized.

By denying any group of experts the status of an established religion, we may divest the advocates of the technological fix of the overrated authority which the demands of war and diplomacy and a powerful coalition of supporting interest groups have foisted on the faithful. R and D budget proposals are no longer treated as sacred texts, partly because policy-makers are more capable of informed skepticism and partly because (after twenty years of exploding science) an automatic control has begun to operate. Science has grown too big too quickly, and too many people are now involved. That means more politics, troublesome, unavoidable, and good for the nation.

AMERICAN ECONOMIC ASSOCIATION

PROCEEDINGS

OF THE

EIGHTIETH

ANNUAL

MEETING

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WASHINGTON, D.C.
DECEMBER 28-30, 1967

PROCEEDINGS OF THE
AMERICAN ECONOMIC ASSOCIATION

ANNUAL BUSINESS MEETING, DECEMBER 29, 1967
SHERATON-PARK HOTEL, WASHINGTON, D.C.

The Eightieth Annual Business Meeting of the American Economic Association was called to order in the Delaware Suite of the Sheraton-Park Hotel, Washington, D.C., at 9:15 p.m. by President Milton Friedman. The minutes of the Business Meeting of December 28, 1966, were approved and the minutes of the Executive Committee meetings and reports of officers and committees of the Association were ratified. These reports are published in these "Proceedings" and constitute the official actions of the Association when approved at the annual meeting.

The report of the Secretary was presented by H. F. Williamson. The schedule of times and places for future annual meetings through 1976 was outlined. Attention was called to the fact that the approximate number of members and subscribers as of December 31, 1967, was 23,305, a net increase of 2,001 for the year.

In addition, the Secretary reported on the following activities of the Association:

1. *Clearinghouse Project.* There are currently over 2,500 individuals in the roster of economists interested in overseas assignments. During 1967, the Project was financed by a grant from AID.

2. *National Register of Scientific and Technical Personnel.* The Association will participate in the 1968 Register of Scientific Personnel under a special arrangement with the National Science Foundation.

3. *Foreign Graduate Student Screening Project.* This project, now in its third year of operation, is prepared to handle requests from economics departments for an evaluation of foreign students from countries in the Middle and Far East, Latin America, and Africa.

4. *Handbook.* The present plans are to gather data for the next comprehensive edition of the *Handbook* during the fall of 1968 for publication early in 1969.

The Treasurer noted that because of the decision made at the March, 1967, Executive Committee meeting to shift from a fiscal to a calendar-year basis, it was not possible to present a Treasurer's Report at this time.

The report of the Managing Editor, published below, was summarized by J. G. Gurley. He expressed his appreciation for the effective work done by the Editorial Board and consultants in preparing the *American Economic Review.*

The Secretary then presented the report of the Committee on Elections and the certification of the election of new officers for the year 1968 as follows:

In accordance with the bylaws on election procedure, I hereby certify the results of the

recent balloting and present the reports of the Nominating Committee and the Committee on Elections.

The Nominating Committee, consisting of Edward S. Mason, Chairman, Harold J. Barnett, Marvin Frankel, Ruth P. Mack, Clarence E. Philbrook, and Edward S. Shaw, presented to the Secretary the list of nominees for the respective offices:

<center>For President-elect
William J. Fellner</center>

For Vice-Presidents	For Executive Committee
Walter W. Heller	Otto Eckstein
Edgar M. Hoover	Lyle C. Fitch
Harry G. Johnson	Ilse Mintz
Robert M. Solow	Anthony D. Scott

The Committee on Elections, consisting of George Dalton, Chairman, Dale Mortensen, and Harold F. Williamson, prepared biographical sketches of the candidates and ballots were distributed shortly after the middle of September. The canvass of the ballots was made on November 10, 1967, and the results were filed with the Secretary.

From the report of the Committee on Elections, I have the following information:

Number of envelopes without name for identification..............	222
Number of envelopes received too late...........................	34
Number of defective ballots.....................................	—
Number of legal ballots...	5,377
Number of returns from the mail ballot.....................	5,633

On the basis of the canvass of the votes cast, I certify that the following persons have been duly elected to the respective offices:

<center>President-elect (one-year term)
William J. Fellner</center>

Vice-Presidents (one-year term)	Members of the Executive Committee (three-year term)
Walter W. Heller	Otto Eckstein
Robert M. Solow	Anthony D. Scott

Following the report of the Committee on Elections, President K. E. Boulding took over the chair.

In response to suggestions from the floor, the President agreed to have the Executive Committee consider the following: (a) the possibility of appointing a standing committee to plan the annual meetings of the Association; (b) possible ways of polling members on public policy issues, specifically the question of the United States involvement in Vietnam; and (c) desirability of changing the charter provisions which prohibit the Association from "taking a partisan attitude" or committing "its members to any position on practical economic questions."

The President recognized James N. Buchanan, who presented the following resolution, which was adopted:

Be it resolved that the Association commend the President-elect and the Program Committee generally for the preparation and implementation of the excellent and varied program that has stimulated research, provoked controversy, and reported to us on scientific progress.

The President then recognized Mark Perlman, who presented the following resolution, which was adopted:

WHEREAS, The several members of the Committee on Local Arrangements have worked hard, long, and well to organize these meetings;

WHEREAS, The complications involved seem to expand almost exponentially with the size of these meetings;

WHEREAS, These are the largest meetings the Association has ever had;

Resolved, That the officers convey to the several members of the Committee on Local Arrangements the thanks of this Association.

The meeting was adjourned at 9:45 p.m.

<div align="right">HAROLD F. WILLIAMSON, Secretary</div>

THE FRANCIS A. WALKER AWARD

CITATION ON THE OCCASION OF THE PRESENTATION OF THE MEDAL TO ALVIN H. HANSEN, DECEMBER 29, 1967

The American Economic Association awards its highest honor, the Francis A. Walker medal, to Alvin H. Hansen, a gentle revolutionary who has lived to see his cause triumphant and his heresies orthodox, an untiring scholar whose example and influence have fruitfully changed the directions of his science, a political economist who has reformed policies and institutions in his own country and elsewhere without any power save the force of his ideas. From his boyhood on the South Dakota prairie, Alvin Hansen has believed that knowledge can improve the condition of man. In the integrity of that faith he has had the courage never to close his mind and to seek and speak the truth wherever it might lead. But, Professor Hansen, we honor you with as much affection as respect. Generation after generation, students have left your seminar and your study not only enlightened but also inspired—inspired with some of your enthusiastic conviction that economics is a science for the service of mankind. By the printed page you have reached countless others throughout the world. Today, from the vantage of your eightieth year, you can see these men and women, in academic and public service everywhere, teaching, applying, adapting, and—you would be the first to hope—improving what you helped them to learn.

MINUTES OF THE EXECUTIVE COMMITTEE MEETINGS

1. Minutes of the spring meeting held in New York City, March 10–11, 1967:

The *first meeting* of the *1967 Executive Committee* was called to order at 9:30 a.m. at the New York Hilton Hotel, New York City, March 10, 1967. The following were present: Milton Friedman, presiding, Moses Abramovitz, K. J. Arrow, W. J. Baumol, K. E. Boulding, J. M. Buchanan, J. G. Gurley, Fritz Machlup, Franco Modigliani, Arthur Smithies, J. J. Spengler, Robert Triffin, and H. F. Williamson. Absent were: N. H. Jacoby and L. R. Klein. Present as members of the Nominating Committee were: E. S. Mason, Chairman, H. J. Barnett, Marvin Frankel, Ruth P. Mack, and C. E. Philbrook; absent, E. S. Shaw. Present as guests were: Richard Ruggles, P. A. Samuelson, James Tobin, and H. A. Tolles.

1. *President's Remarks* (Milton Friedman). President Friedman outlined the items on the agenda to be covered at the meetings.

2. *Minutes.* The minutes of the Executive Committee meeting of December 26, 1966, were approved.

3. *Report of the Secretary* (H. F. Williamson).

Annual Meetings. The preliminary report indicated a total net registration at the San Francisco meeting of approximately 4,300. A report on the placement service operated under the auspices of the U.S. Employment Service at the San Francisco meeting indicated that the total number of job applications filed was 1,765 and the total number of job openings was 2,359.

Following a discussion of arrangements for the 1967 annual meeting in Washington, D.C., it was decided: (a) to schedule the meeting for December 28–30; (b) to follow a daily time schedule of two morning sessions, 8:30–10:15 and 10:30–12:30, and one afternoon session, 2:30–4:30; (c) to hold the meeting of the Executive Committee on December 27, starting with luncheon at 12:30.

Papers and Proceedings. It was announced that the plan was to print 24,500 copies of the 1967 *Papers and Proceedings* and that the total number of manuscript pages would be approximately 1,290.

Clearinghouse Project. The Secretary reported that a contract had been signed with AID which will finance the operations of the Clearinghouse Project through February, 1968, with the understanding that a new contract will be negotiated at that time.

N.S.F. Register of Scientific Personnel. Plans are being worked out for the Association's participation in the 1968 Register of Scientific Personnel.

Foreign Student Screening Project. There has been a substantial increase during 1966–67 in the number of requests for the services of the Foreign Student Screening Project. The Secretary suggested that the project be reviewed at the next meeting of the Executive Committee.

4. *Report of the Treasurer* (H. F. Williamson). The Treasurer presented a budget estimate for fiscal 1967. He noted that it had been decided to issue a "who's who" type of *Handbook* in 1968.

5. *Report of the Managing Editor, A.E.R.* (J. G. Gurley). The Editor asked for recommendations of candidates to replace the members of the Editorial Board whose terms will expire in 1967. He also reported that the members of the Editorial Board were generally in favor of including book reviews, symposia, and surveys of current literature in the *Journal of Economic Abstracts* and had concurred with the decision to discontinue the listing in the *Review* of titles of dissertations in progress. He asked for the reactions of the members of the Executive Committee to the following: should payments to the authors of articles in the *American Economic Review* be eliminated; is it possible to improve the system of footnote references presently followed by the *Review*; and what should be the policy of the Editor regarding articles written by members of the Editorial Board? Following a discussion, it was agreed: that further consideration should be given to the advisability of eliminating payments to authors; that the possibility of improving the footnote reference system should be explored; and that the articles by members of the Editorial Board should be considered for publication.

6. *Report of the Managing Editor, J.E.A.* (Arthur Smithies). The Editor outlined the changes in the format and the coverage of the *Journal of Economic Abstracts* during 1966. He noted that the editorial policy of the *Journal* was originally to confine itself to articles from journals of fairly general interest to economists and to exclude highly specialized journals, but this policy has been modified recently by allowing specialized journals to submit abstracts of articles of general interest. He further noted that the expanded coverage by the *Journal* has been made in response to requests from editors and nothing has been solicited. The Editor then sub-

mitted the following budget to cover the operations of the *Journal* for 1967: editor's salary, $1,500; assistant editor's salary, $775; secretarial, $500; postage, telephone, supplies, $60; a total of $2,835. It was VOTED to accept the report of the Editor and to approve the budget.

7. *Reports of Standing and Special Committees.*

Committee on Research and Publications (I. B. Kravis). In the absence of the Chairman, Franco Modigliani outlined the status of the various publications sponsored by the Committee. He noted specifically that it had been agreed to set aside a sum of $5,000 each for the following: (a) the translation of significant articles in French economic history, with the possibility that Rondo Cameron would serve as editor of the volume and (b) the translation of abstracts and essays relating to Japanese economic history. He further noted that negotiations are under way for a revision of the Association's publishing contract with Richard D. Irwin, Inc., for the purpose of reducing the prices of the publications sponsored by the Association. Following a discussion, it was agreed that the Association rather than Irwin might advance the $2,000 paid to editors of the "Survey" and "Readings" volumes if such an arrangement would reduce the sale price of future volumes. The question of the advisability of staggering the terms of the members of the Committee on Research and Publications, appointed by the President, was raised. Following a discussion, it was suggested that as a matter of policy the terms of all appointed members of the Committee should expire prior to the December meeting of the Executive Committee, and that Harry Johnson be reappointed for 1967, Bert Hoselitz for 1967 and 1968, and Irving Kravis for 1967–69.

Advisory Committee on the Study of the Structure of the Profession (K. A. Fox). In the absence of the Chairman, William Baumol and Arnold Tolles reported that the Committee at its meeting on January 27 had recommended that Arnold Tolles continue his research on the structure of the profession. Following a discussion, it was agreed that an application would be made to the National Register for funds to continue the research project beyond July 31, 1967. It was VOTED that if funds were not available from the National Register, the Association would finance the research.

Committee on the A.E.R. and the J.E.A. (Milton Friedman). The Chairman noted that the following questions were discussed at the meeting of the Committee in San Francisco on December 27: (a) the terms of the present Editors, (b) the character of the *American Economic Review* and the *Journal of Economic Abstracts*, and (c) the advisability of dropping the list of proposed doctoral dissertation titles in the *Review*. With regard to the terms of the present Editors, it was emphasized that the Committee would have to start promptly to search for someone to replace John Gurley, who has indicated that he does not wish to continue as Editor of the *American Economic Review* beyond his present term, which ends January 1, 1969. There is a further possibility of a need to replace Arthur Smithies as Editor of the *Journal of Economic Abstracts* should he decide not to continue. In respect to the character of the *A.E.R.* and the *J.E.A.*, the members of the Committee proposed that the *Review* concentrate on the publication of original scholarly work and the *Journal* be converted into a journal of economic literature that would attempt to provide a broad review of literature currently appearing by including the abstracts, titles of journal articles, book reviews now carried in the *Review*, and articles reviewing literature in specific areas. On the question of the list of dissertations in the *Review*, the Editor was asked to consider the possibility of eliminating highly tentative titles.

Committee on Classification (R. H. Leftwich). In the absence of the Chairman, Richard Ruggles outlined an extensive report he had prepared for the Committee on Classification in which he noted the differences in the classification systems used by the *Index of Economic Journals*, the *American Economic Review*, the *Journal of Economic Abstracts*, and the A.E.A. *Handbook*. He pointed out the potential advantages of developing a classification system that could be used for all purposes. He recommended that: (a) a three-level classification system based on the *Handbook* and the *Index of Economic Journals* be explored; (b) the classification system developed should be adapted to the computer to facilitate further indexing; and (c) if the bibliographical effort of the A.E.A. is to be integrated and made more comprehensive, this be recognized as a service to the economics profession and support obtained for it. Following a discussion, it was agreed that the Committee should follow the recommendations made by Richard Ruggles.

Index of Economic Festschriften (Richard Ruggles). The Chairman reported that approximately 126 volumes have already been indexed and that work is proceeding satisfactorily on the project. Following the discussion, it was VOTED to allocate $10,000 to Yale University to finance the preparation of the *Index of Economic Festschriften*.

Committee on the Proposed National Foundation for the Social Sciences (J. J. Spengler). The Chairman outlined the current status of the proposals in Congress to establish a National Social Science Foundation, indicating that hearings on the proposed bills will probably start within the next few weeks. Following a discussion, it was agreed that: (a) Joseph Spengler prepare a report on the proposed legislation to be published in the June issue of the *American Economic*

Review and (*b*) that while it would be inappropriate for the Association to adopt an official position regarding the National Social Science Foundation, the Chairman and officers will, upon request, suggest names of economists qualified to testify at the legislative hearings.

Committee on Honors and Awards (James Tobin). Following a report by the Chairman, a ballot was taken to select the recipients of the Francis A. Walker and the John Bates Clark medals and the Distinguished Fellow award. It was VOTED to instruct the President to ask members of the Committee on Honors and Awards to accept staggered appointments.

Nominating Committee (E. S. Mason). The Executive and Nominating Committees met as an Electoral College to consider the nominees for office of President-elect for 1968. After discussion, the nominee was selected and his acceptance obtained. Nominees for the other offices were also discussed.

8. *Reports of A.E.A. Representatives and Advisory Committees.*

S.S.R.C. (K. A. Fox). An extensive report on the organization and functioning of the Council, prepared by Karl Fox, was distributed at the meeting. The Secretary was instructed to express the appreciation of the Executive Committee to Karl Fox for the report and to keep copies on file for the benefit of future Association representatives to the S.S.R.C.

I.E.A. (P. A. Samuelson). Paul Samuelson outlined the plans for the International Economic Association congress to be held in Montreal during the first week of September, 1968, and suggested how the American Economic Association might assist in organizing the meetings. It was agreed that the *American Economic Review* would carry announcements of the congress and that the Secretary should work with Harry Eastman, of the University of Toronto, on local arrangements. It was VOTED to pay annual dues of $600 to the I.E.A.

National Research Council, Division of Behavioral Sciences. Milton Friedman noted that the Association had been asked to appoint representatives to the Advisory Committee of the Division of the Behavioral Sciences. In view of the fact, however, that the Division of the Behavioral Sciences had already asked Carl Kaysen and Robert Solow to serve on the Advisory Committee and in turn to set up a panel of representative economists, he proposed that Kaysen and Solow also be asked to serve as the Association's representatives to the Advisory Committee. It was VOTED to accept this recommendation.

9. *Unfinished and Miscellaneous Business.*

It was VOTED to reappoint H. F. Williamson for another three-year term as Secretary-Treasurer, starting January 1, 1968.

It was suggested that consideration be given to preparing a comprehensive report on graduate training in economics.

President-elect K. E. Boulding discussed his plans for the program for the 1967 meeting. Meeting was adjourned at 11:45 a.m. on March 11, 1967.

2. Minutes of the meeting held in Washington, D.C., December 27, 1967:

The *second meeting* of the *1967 Executive Committee* was called to order at 1:45 p.m. at the Sheraton-Park Hotel, Washington, D.C., December 27, 1967. The following were present: Milton Friedman, presiding, K. J. Arrow, W. J. Baumol, K. E. Boulding, J. M. Buchanan, J. G. Gurley, L. R. Klein, Fritz Machlup, Arthur Smithies, J. J. Spengler, Robert Triffin, and H. F. Williamson. Absent were: Moses Abramovitz, N. H. Jacoby, and Franco Modigliani. Present as guests were: A. W. Coats, Otto Eckstein, W. J. Fellner, Rendings Fels, R. H. Leftwich, L. W. McKenzie, W. F. Owen, Mark Perlman, Richard Ruggles, Phillip Saunders, Anthony Scott, and R. M. Solow.

1. *President's Remarks* (Milton Friedman). President Friedman outlined the major items on the agenda to be covered at the meeting.

2. *Minutes.* The minutes of the Executive Committee meeting of March 10–11, 1967, were approved.

3. *Report of the Secretary* (H. F. Williamson). The Secretary presented the schedule of future meetings, membership growth, publication costs of the *Papers and Proceedings*, and a review of various activities of the Association—all more fully treated in the Secretary's Report as shown below.

It was VOTED to approve and accept the Secretary's Report.

It was VOTED to hold the spring meeting of the Executive Committee in New York City, March 8–9, 1968, at the New York Hilton Hotel.

4. *Report of the Treasurer* (H. F. Williamson). The Treasurer noted that because of the decision made at the March, 1967, meeting of the Executive Committee to shift the Association's accounting period from a fiscal to a calendar-year basis, his report would be made at the spring meeting of the Executive Committee.

5. *Report of the Managing Editor of the American Economic Review* (J. G. Gurley). The Editor reviewed the report on the operations of the Editorial Office of the *American Economic Review*, published in full below. He also noted that upon the recommendation of the Editorial

Board, it was decided to discontinue the listing of titles of Ph.D. dissertations in process in the *American Economic Review* in favor of publishing titles and abstracts of completed dissertations. The report was accepted and it was VOTED to: (*a*) approve the excess of expenditures by the Editorial Office in 1967 over the budgeted amount authorized originally by the Executive Committee; (*b*) accept the proposed budget for 1968 of $117,647; and (*c*) approve the appointment to the Board of Editors of Gary Becker, Irwin Friend, and Warren Smith for three-year terms beginning in 1968.

6. *Report of the Managing Editor of the Journal of Economic Abstracts* (Arthur Smithies). The Editor reviewed the report on the operation of the Editorial Office of the *Journal of Economic Abstracts*, printed in full below. The report was accepted, and it was VOTED to approve the proposed budget of $3,060, to cover operations during the period of December 1, 1967, to November 30, 1968.

7. *Reports of Standing and Special Committees.*

Committee on Research and Publications (I. B. Kravis). In the absence of the Chairman, Bert Hoselitz reported briefly on the "Translation Series."

Index of Economic Festschriften (Richard Ruggles). Richard Ruggles outlined the report printed in full below. Following a discussion, it was VOTED to make a supplementary grant of $750 to complete the *Index of Festschriften* with the understanding that Professor Ruggles would prepare a proposal for carrying the *Index of Festschriften* back to cover materials published before 1960.

Committee on Classification (Richard Leftwich). The Chairman reviewed the report of the Committee, printed below.

Committee on Economic Education (G. L. Bach). In the absence of the Chairman, Rendigs Fels summarized the report, printed below.

The A.E.A. Visiting Scientists Program (Phillip Saunders). Mr. Saunders outlined the activities of the A.E.A. Visiting Scientists Program, printed below.

Committee on Honors and Awards (James Tobin). No report.

Advisory Committee on the History of the Association (G. J. Stigler). In the absence of the Chairman, A. W. Coats outlined his plans for completing the history of the Association.

Committee on the A.E.R. and the J.E.A. (Milton Friedman). The Chairman reviewed the proposals for future operations of the *American Economic Review* and the *Journal of Economic Abstracts*. It was VOTED: (*a*) to change the name of the *Journal of Economic Abstracts* to the *Journal of Economic Literature*; and (*b*) to appoint Mark Perlman as Editor with the understanding that the first issue of the *Journal of Economic Literature* would be published during the first quarter of 1969. It was VOTED to appoint a committee to advise and assist the Editor of the *Journal of Economic Literature*.

8. *Reports of A.E.A. Representatives and Advisory Committees.*

A.C.L.S. (R. L. Andreano). The Secretary read a letter from Professor Andreano, recommending that the Association increase its annual dues as requested by the President of the Council. Following discussion, it was VOTED to raise the annual dues to the A.C.L.S. from $100 to $500.

S.S.R.C. (K. A. Fox). Karl Fox gave a brief outline of recent activities of the S.S.R.C.

N.B.E.R. (W. L. Thorp). The written report submitted by W. L. Thorp is printed below.

I.E.A. (Fritz Machlup). Fritz Machlup presented the report, printed below.

Economics Institute Advisory and Policy Board (W. F. Owen). Wyn Owen outlined his report on the Economics Institute, printed below.

Census Advisory Board (Solomon Fabricant). See report printed below.

National Research Council, National Academy of Sciences, Division of Behavioral Sciences (L. W. McKenzie). Lionel McKenzie reviewed the report prepared by James N. Morgan, printed in full below.

Consortium of Professional Associations for the Study of Teacher Improvement Programs (G. H. Evans). The Secretary read a brief report from G. H. Evans, indicating that the chief purpose of the Consortium has been to evaluate, in general terms, the various teacher-training programs. In line with this objective, the Executive Board of the Consortium, of which Professor Evans is a member, has been particularly concerned with the development of new instructional models to bridge the gap between subject areas and teacher education. The Consortium has on the whole been doing a good job, despite its dependence to date upon hand-to-mouth financial support.

9. *Unfinished and Miscellaneous Business.*

Following a discussion, it was VOTED to recommend that Article III, Section 3, of the Bylaws be amended to read as follows: "The Association shall have the following officers who shall be appointed by the Executive Committee: a Secretary, a Treasurer, a Managing Editor of the *American Economic Review*, a Managing Editor of the *Journal of Economic Literature*, and a Counsel. The terms of office of each of these officers shall be three calendar years." It was VOTED to recommend that Article III, Section 4, be amended to read as follows: "The

Executive Committee shall consist of the President, the President-elect, two Vice-Presidents, the Secretary, the Treasurer, the two Managing Editors, the two ex-Presidents who have last held office, and six elected members, provided that the Secretary, the Treasurer, and the two Managing Editors shall not be entitled to vote in the Committee's meetings."

The President raised the question of the Association's policies with regard to exhibitors at the annual meeting and advertisers in the *American Economic Review*. It was agreed that only exhibits or advertisements clearly of service or interest to our members should be accepted.

The meeting was adjourned at 9:45 p.m.

REPORT OF THE SECRETARY FOR THE YEAR 1967

Annual Meetings. The final report for the 1966 annual meeting in San Francisco indicated a net registration of 3,825. Gross registration amounted to 4,687 of which 2,920 (62 percent) were members of the American Economic Association. The net income from the meeting was $25,198.17. The Association's share, based on the number of members who registered, was $16,288.28.

The schedule for future annual meetings is: 1968, Chicago, Pick-Congress Hotel; 1969, New York, New York Hilton; 1970, Detroit, Sheraton-Cadillac; 1971, New Orleans (if hotel accommodations are available); 1972, Chicago, Conrad Hilton Hotel; 1973, New York, New York Hilton; 1974 (not selected); 1975, Chicago, Conrad Hilton Hotel; 1967, Philadelphia.

Dr. William Hocter, of the Federal Reserve Bank of Chicago, will serve as Chairman of the Local Arrangements Committee for the 1968 annual meeting in Chicago.

Membership. Exhibit I below shows that as of December 31, 1967, the total number of members and subscribers was 23,305, a net increase of 2,001 for the year.

Handbook. Present plans call for the gathering of data during the late fall of 1968 for a new edition of the *Handbook*, to be published early in 1969.

Advertising and Announcements. There were 192 pages of paid advertising and 50½ pages of exchange advertising in the *American Economic Review* and the *Paper and Proceedings* compared with 183½ paid and 52½ exchange pages in 1966. Advertising income for 1967 was $49,986, compared with $52,982 for 1966. The "Vacancies and Applications" announcements increased from 47 pages in 1966 to 59 pages in 1967.

Papers and Proceedings. A comparison of the size and cost of the *Papers and Proceedings* for the period 1957–67 is shown in Exhibit II.

Permission to Reprint and Translate. Official permissions to quote from, reprint, or translate articles from the *American Economic Review* and the *Papers and Proceedings* rose from 215 in 1966 to 234 in 1967. Some 84 permissions granted in 1967 were in response to requests to reproduce or reprint articles for classroom or conference use.

Use of the Mailing List. The policy of the Association is to grant requests for the use of the mailing list only if the material to be distributed appears to be of interest to a substantial proportion of our members. Income from the sale of the mailing list during 1967 was approximately $9,000, up about $1,500 from income from this source in 1966.

Clearinghouse Project. There are approximately 2,500 economists interested in overseas assignments registered with the American Economic Association Clearinghouse Project. Financial support for the Project during 1967 came from AID. Since budgetary restrictions make it unlikely that this support can be continued during 1968, consideration is being given to the possibility of transferring the operation to Overseas Educational Services.

National Register of Scientific and Technical Personnel. Under a contract with the National Science Foundation, the Association will participate for the third time in the 1968 survey of scientific and technical personnel in the United States. The National Science Foundation is also providing financial support for a comparative analysis of the data on economists included in the 1964 and 1966 Registers of Scientific and Technical Personnel.

Foreign Student Screening Project. Under the Foreign Student Screening Project, the Association continued during 1967 to answer requests for evaluations of candidates from the major countries in the Middle East, Far East, Latin America, and Africa who applied for admission as graduate students to American and Canadian departments of economics and agricultural economics. Serious consideration is being given to the possibility of publishing a revised edition of the guide to *Graduate Study in Economics* in the United States early in 1969.

Employment Service. According to the final report on the operation of the U.S. Employment Service at the 1966 annual meeting in San Francisco, the number of job openings listed was 2,359 and the number of registered applicants was 1,765.

Group Flights. There was sufficient interest only among the members of the Allied Social Science Associations in the Chicago area to schedule a group flight to the 1967 annual meeting in Washington, D.C.

Asia Foundation Grant. The Asia Foundation made a grant of $2,500 to the Association on August 8, 1967. This sum is to be used for membership dues and subscriptions and payments toward expenses of attending professional meetings of economists. In 1967, the Foundation limited the amount of travel assistance to $50 per individual.

Standing Committees

ADVISORY COMMITTEE ON THE STUDY OF THE STRUCTURE OF THE PROFESSION

Karl A. Fox, *Chairman*
William J. Baumol
Gary S. Becker
Francis M. Boddy

ADVISORY COMMITTEE ON THE HISTORY OF THE ASSOCIATION

George J. Stigler, *Chairman*
Harold F. Williamson
Joseph Dorfman

ADVISORY COMMITTEE ON THE INDEX OF ECONOMIC JOURNALS

Richard Ruggles, *Chairman*

CENSUS ADVISORY COMMITTEE

Solomon Fabricant, *Chairman* (1968)
Sherman J. Maisel (1967)
Ralph W. Pfouts (1967)
Gideon Rosenbluth (1967)
Daniel Creamer (1968)
H. Gregg Lewis (1968)
John Lintner (1968)
Arthur M. Okun (1968)
Morris A. Adelman (1969)
Robert R. Nathan (1969)
Fred H. Klopstock (1969)
Ernest Williams, Jr. (1969)
Douglass C. North (1969)
Guy H. Orcutt (1970)
Gary Fromm (1970)

TECHNICAL SUBCOMMITTEE ON BUSI-
NESS CYCLE DEVELOPMENTS

Geoffrey H. Moore (1968)
Arthur K. Okun (1968)
Frank E. Morris (1969)
Harry Stark (1969)
Gottfried Haberler (1970)
Bert G. Hickman (1970)
Donald J. Daly (1971)
Gary Fromm (1971)
Beryl W. Sprinkel (1971)
Kenneth B. Williams (1971)

COMMITTEE ON ADMINISTRATIVE
STAFF SALARIES

Fritz Machlup
Milton Friedman
Kenneth E. Boulding

COMMITTEE ON THE AMERICAN ECO-
NOMIC REVIEW AND THE JOUR-
NAL OF ECONOMIC ABSTRACTS

Milton Friedman, *Chairman*
Bernard F. Haley
Neil H. Jacoby
Robert H. Strotz
Fritz Machlup
Kenneth E. Boulding
Harold F. Williamson, Ex Officio

COMMITTEE ON CLASSIFICATION

Richard H. Leftwich, *Chairman*
Richard Ruggles
John G. Gurley
Arthur Smithies
Harold F. Williamson

COMMITTEE ON ECONOMIC EDUCA-
TION

G. L. Bach, *Chairman* (1967)
Marshall R. Colberg (1967)
Rendigs Fels (1967)
Emanuel T. Weiler (1967)
Henry H. Villard (1969)
Ben W. Lewis (1969)
Kenneth E. Boulding (1969)
Harold F. Williamson, Ex Officio

COMMITTEE ON HONORS AND
AWARDS

James Tobin, *Chairman* (1970)
Anthony D. Scott (1970)
Richard A. Musgrave (1970)
George P. Shultz (1972)
Douglass C. North (1972)
William H. Nicholls (1972)

COMMITTEE ON RESEARCH
AND PUBLICATIONS

Irving B. Kravis, *Chairman*
(1969)
Karl A. Fox (1967)
Franco Modigliani (1968)
Albert Rees (1969)
Willard L. Thorp (1970)
Bert F. Hoselitz (1968)
Harry Johnson (1967)
Harold F. Williamson, Ex Officio

INSTITUTE OF INTERNATIONAL
EDUCATION, ADVISORY AND
POLICY BOARD

Henry Rosovsky, *Chairman*
(1968)
Simon Rottenberg (1968)
Raymond Mikesell (1968)
Neil W. Chamberlain (1969)
H. Gregg Lewis (1969)
Douglass C. North (1970)
Vernon W. Ruttan (1970)

JOINT COMMITTEE WITH THE
AMERICAN ASSOCIATION OF
LAW SCHOOLS

Armen A. Alchian
Ronald H. Coase
Mark S. Massel
Gerald M. Meier
George J. Stigler

JOINT COUNCIL ON ECONOMIC
EDUCATION, SPECIAL
ADVISORY COMMITTEE

G. L. Bach (1967)
Rendigs Fels (1967)
Ben W. Lewis (1969)

Committees Appointed During the Year

COMMITTEE ON ELECTIONS

George Dalton, *Chairman*
Dale Mortensen
Harold F. Williamson, Ex Officio

**COMMITTEE ON PROPOSED
NATIONAL FOUNDATION FOR
THE SOCIAL SCIENCES**

Joseph J. Spengler, *Chairman*

FINANCE COMMITTEE

C. Wells Farnham, *Chairman*
Corliss D. Anderson
Harold F. Williamson

NOMINATING COMMITTEE

Edward S. Mason, *Chairman*
Harold J. Barnett
Marvin Frankel
Ruth P. Mack
Clarence E. Philbrook
Edward S. Shaw

Council and Other Representatives

A.A.A.S.

Carl Kaysen (1968)

A.C.L.S.

Ralph L. Andreano (1970)

**CONSORTIUM OF PROFESSIONAL
ASSOCIATIONS FOR THE STUDY
OF TEACHER IMPROVEMENT
PROGRAMS**

G. Heberton Evans
Warren C. Scoville

I.E.A.

John T. Dunlop (1968)
Fritz Machlup (1970)

N.B.E.R.

Willard L. Thorp (1970)

**NATIONAL COUNCIL OF TESTING
OF ENGLISH AS A FOREIGN
LANGUAGE**

Arthur E. Burns

**NATIONAL RESEARCH COUNCIL OF
THE NATIONAL ACADEMY OF
SCIENCES**

James N. Morgan (1968)
James Tobin (1969)
Lionel W. McKenzie (1970)

S.S.R.C.

Karl A. Fox (1967)
Franco Modigliani (1968)
Albert Rees (1969)

Representatives of the Association on Various Occasions

NATIONAL COUNCIL FOR THE SOCIAL STUDIES
J. R. Huber

SEVENTY-FIFTH ANNIVERSARY CONVOCATION, ITHACA COLLEGE
Thomas Davis

INAUGURATIONS

Robert Joseph Wert, Mills College
Edward S. Shaw
Martin Meyerson, State University of New York at Buffalo
David I. Fand

Bernard Adams, Ripon College
  M. H. Westhagen
Thomas Hedley Reynolds, Bates College
  Paul G. Darling
Burton Crosby Hallowell, Tufts University
  Newlin R. Smith
Robert Christian Kramer, California State Polytechnic College
  Arthur Kemp
Maurice B. Mitchell, University of Denver
  John V. Van Sickle
Prezel Russell Robinson, St. Augustine College
  Ralph W. Pfouts
F. Clark Elkins, Northeast Missouri State Teachers College
  Walter Johnson

HAROLD F. WILLIAMSON, *Secretary*

EXHIBIT I

MEMBERS AND SUBSCRIBERS

	Totals 11/30/66	Gain or *Loss*	Totals 12/31/67
Class of membership:			
Annual..................	12,820	1,197	14,017
Junior..................	1,819	212	2,031
Family..................	196	30.	226
Complimentary..........	123	1	122*
Life.....................	254	8	262
Honorary...............	17	—	17
Total members.........	15,229	1,446	16,675
Subscribers...............	6,075	555	6,630
Totals................	21,304	2,001	23,305

* Includes 55 who do not receive the publications.

EXHIBIT II

PUBLICATION COSTS

	PAPERS AND PROCEEDINGS			HANDBOOKS		
Year*	Number of pages	Number of copies	Cost	Number of pages	Number of copies	Cost
1957	754	12,400	$16,253	548	10,100	$15,815
1958	677	12,700	15,471	32	9,300	1,434
1959	689	14,000	16,780			
1960	745	14,800	18,914			
1961	675	15,800	19,759			
1962	615	16,000	18,277			
1963	753	17,700	23,440			
1964	698	18,500	23,362	472	16,000	48,626
1965	652	20,000	23,264			
1966	670	22,500	28,405	184	23,000	13,261
1967	741	24,000	32,284			

* This is the year of publication and pertains to the meeting of the preceding year.

REPORT OF THE FINANCE COMMITTEE

Executive Committee
American Economic Association
Evanston, Illinois

Gentlemen:

The accompanying tables list the securities held by the Association at the end of the calendar year, December 31, 1967, and changes made during the period November 30, 1966, through December 31, 1967. The fiscal year of the Association formerly ended November 30 and was changed to a calendar-year basis in 1967, which accounts for the thirteen months' interval between year-ends. Table 1 provides a classified list of bonds and stocks and records the costs and the market values on December 31, 1967.

The total market value of the securities account as of December 31, 1967, was $544,772 compared to $458,324 at the end of the previous fiscal year, November 30, 1966. There were few changes made in the investment account and no net additions during the period to the investments in either stocks or bonds. One international oil stock, Gulf Oil, was switched into Atlantic Richfield and 50M short-term government bonds were converted into long-term, high-yielding corporate bonds. Three of the stocks held, Marsh McLennan, Eastern Air Lines, and Disney Productions, were split 2-for-1. Other changes were nominal, consisting of stock dividends.

C. Wells Farnham, *Chairman*

TABLE 1

INVENTORY AND APPRAISAL OF SECURITIES AND CASH AS OF 12/31/67

	Par or Shares	Market Value	Cost
CASH AND SHORT-TERM OBLIGATIONS			
CASH			
Governments			
U. S. Treas. 4¼ 8/15/68.............................	5M	4,950	5,000
U. S. Treas. 5⅝ 2/15/68.............................	20M	20,000	20,000
U. S. Treas. 3¾ 11/15/71............................	20M	18,600	20,000
U. S. Treas. 2½ 12/15/72-67........................	15M	13,200	15,275
TOTAL CASH AND SHORT-TERM SECURITIES.........		56,750	
Long-Term Bonds and Preferred Stocks			
Anheuser Busch 6 7/1/92............................	10M	9,800	10,000
Corn Products 5¼ 8/15/92..........................	10M	9,200	9,950
General Telephone 6¼ 12/1/91......................	20M	19,400	20,530
Pet, Inc. 5⅜ 6/1/92.................................	10M	9,400	9,900
TOTAL LONG-TERM BONDS AND PREFERRED STOCKS..		47,800	
Convertible Securities Preferred Stocks			
Union Oil 2.50 CV PFD.............................	200	15,000	12,890
TOTAL CASH AND FIXED INCOME SECURITIES........		119,550	
COMMON STOCKS			
Utilities			
Central & South West..............................	300	13,800	2,100
Houston Lighting & Power..........................	200	9,200	827
Peoples Gas Light & Coke..........................	275	9,350	3,560
		32,350	
Financial			
First Bank Stock..................................	400	16,800	12,690
LaSalle National Bank..............................	220	5,720	7,675
Marsh & Mc Lennan...............................	200	12,800	3,685
St. Paul Fire & Marine.............................	200	11,800	12,640
Wells Fargo Bank.................................	175	6,125	3,521
		53,245	
Merchandising-Apparel-Textiles			
Montgomery Ward.................................	150	3,750	5,013
Paper and Textiles			
Inland Container..................................	150	4,500	4,944
Machinery and Construction			
Deere & Co.......................................	200	10,600	4,240
Rex Chain Belt....................................	300	15,000	6,620
		25,600	
Transportation			
Eastern Air Lines.................................	200	9,400	8,950
United Air Lines..................................	100	6,600	6,110
		16,000	
Mining and Metals			
International Nickel...............................	100	11,700	3,911
McIntyre Porcupine Mines..........................	100	8,800	4,818
		20,500	
Oil and Gas			
Atlantic Richfield.................................	100	10,500	9,625
Marathon Oil.....................................	100	8,200	5,630
Royal Dutch......................................	400	19,200	15,955
Std. Oil of Indiana................................	200	10,800	3,650
		48,700	
Chemicals and Drugs			
Abbot Laboratories................................	300	14,100	6,135
Olin Mathieson...................................	200	14,400	8,730
		28,500	

TABLE 1 (*Continued*)

	Par or Shares	Market Value	Cost
Electrical Products			
Motorola..	150	17,550	6,745
Westinghouse Electric............................	200	14,000	11,615
Zenith Radio...................................	300	17,100	1,975
		48,650	
Office Equipment			
International Business Machines...................	61	38,247	10,169
Xerox..	50	15,150	5,305
		53,397	
Miscellaneous			
Disney Productions..............................	454	24,970	8,298
R. R. Donnelley.................................	300	14,100	9,795
Jostens...	1000	28,000	15,220
		67,070	
Foreign			
Bayer A. G.....................................	150	6,900	6,820
Siemens, A. G...................................	110	7,260	5,520
Swedish Ball Bearing	200	8,800	14,525
		22,960	
TOTAL COMMON STOCKS.........................		425,222	
TOTAL SECURITIES AND CASH....................		544,772	

TABLE 2

SUMMARY OF SECURITIES PURCHASED AND SOLD THIRTEEN
MONTHS ENDED DECEMBER 31, 1967

Purchases-Stocks	*Shares*	*Cost*
Atlantic Richfield...	100	$9,674.00
Sales-Stocks		
Gulf Oil...	200	12,549.08
Purchases-Bonds	*Amount*	*Cost*
Anheuser Busch 6% due 7/1/92................................	10M	10,000
Corn Products 5 3/4% due 8/16/92...........................	10M	9,950
Pet, Inc. 5 7/8% due 6/1/92.................................	10M	9,900
General Telephone 6 1/4% due 12/1/91.......................	20M	20,530
Sales-Bonds		
U. S. Treas. 4 7/8% due 11/15/67............................	50M	50,000
Stock Dividends and Splits		
LaSalle National Bank 10% Stock Dividend...................		
I. B. M. 2% Stock Dividend.................................		
Walt Disney Productions 2/1 Stock Split and 3% Stock Dividend.		
Eastern Air Lines 2/1 Stock Split...........................		
Marsh & McLennan 2/1 Stock Split..........................		

AMERICAN ECONOMIC REVIEW

REPORT OF THE MANAGING EDITOR FOR THE YEAR ENDING DECEMBER, 1967

The number of manuscripts submitted during 1967 was 534, which is a record high and more than double the level of the mid-1950's. In the past decade, annual submissions of manuscripts have grown at an average annual rate of almost 10 percent; in the last five years, by almost 15 percent. Table 1 shows these figures for each year since 1948; it also records the number of manuscripts published each year, and the ratios of published papers to the totals received. During the past year, 94 papers were published and only 64 were accepted, reducing substantially the fairly large backlog of papers awaiting publication. The large jump in published papers this year is mostly owing to their brevity, which is an outcome that I and the Board of Editors have encouraged.

TABLE 1

MANUSCRIPTS SUBMITTED AND PUBLISHED, 1948–67

Year	Submitted	Published	Ratio of Published to Submitted
1948	204	48	.23
1949	200	53	.27
1950	197	53	.27
1951	222	49	.22
1952	190	47	.25
1953	234	51	.22
1954	231	47	.20
1955	245	41	.17
1956	242	48	.20
1957	215	40	.19
1958	242	46	.19
1959	279	48	.17
1960	276	46	.17
1961	305	47	.15
1962	273	46	.17
1963	329	46	.14
1964	431	67	.16
1965	420	59	.14
1966	451	62	.14
1967	534	94	.18

Table 2 provides the breakdown of the 1967 volume's contents between articles, review articles, communications, book reviews, etc. Similar information for 1965 and 1966 is also shown. The number of pages devoted to leading articles was lower this year than last, but communications were substantially higher. The absence of listings of periodicals in 1967 was owing to the transfer of this section early in 1966 to the *Journal of Economic Abstracts*.

TABLE 2

SUMMARY OF CONTENTS, 1965-67

	1967		1966		1965	
	Number	Pages	Number	Pages	Number	Pages
Leading articles.......	30	539	25	595	17	443
Review articles........	3	41	0	0	1	22
Communications:						
Original.............	24	138	13	83	12	110
Comments and replies	37	178	24	114	29	118
Books reviewed........	196	376	210	417	189	377
Classified lists:						
New books.........		77		71		77
Periodicals..........		—		15		84
Dissertations........		52		39		43
Notes...............		64		57		53
		1,465*		1,392*		1,327*

* Includes some blank pages.

Table 3 shows the several most popular "fields" in 1967, as reflected in the subject matter of all manuscripts submitted during the year. Almost 20 percent of all manuscripts submitted fell in the three areas of monetary economics, international economics, and public finance; about 40 percent fell in the seven areas listed below. Other popular fields, not shown in the table, were industrial organization and education and health.

TABLE 3

NUMBER OF MANUSCRIPTS SUBMITTED IN THE MOST POPULAR FIELDS IN 1967

Monetary and banking theory and policy.....................	39
International trade and finance.............................	38
Fiscal and tax theory and policy............................	32
Economics of underdeveloped countries.....................	30
Micro-theory...	30
Production functions; technical change.....................	18
Labor economics..	17

Table 4 summarizes the subject-matter distribution of accepted articles, review articles, and communications for 1967. The most interesting figures are those for articles and original communications, since to some extent these figures indicate the areas in which most work of publishable quality and of broad interest to economists is being done. The table shows, however, that we have accepted manuscripts in almost all of the listed areas.

TABLE 4

SUBJECT-MATTER DISTRIBUTION OF ACCEPTED MANUSCRIPTS IN 1967

	Articles	Review Articles	Original Communications	Comments; Replies	Totals
General economics.................				1	1
Price theory......................	1		4	8	13
Income theory....................	4	1	1	5	11
History of economic thought........	1				1
Economic history..................			1	2	3
Economic development; national economies.......................	2		2	1	5
Economic statements and accounting	1				1
Money and banking...............	1				1
Public finance....................	2			1	3
International economics............	2		2	6	10
Business finance..................				1	1
Business organization and administration............................	1				1
Industrial organization.............	1		2	2	5
Land economics; housing; etc........	1		1		2
Labor economics..................	1		1	2	4
Population: welfare; etc............			1		1
Unclassified......................	1				1
Totals.......................	19	1	15	29	64

Table 5 presents the actual annual expenditures from 1963 through 1967 for the four regular issues of the *Review* and the estimated budgets for 1967 and 1968. Actual expenditures have risen since 1963 owing principally to increases in printing and mailing expenses and to higher office costs—the former because of the increased number of pages per copy and the larger number of copies printed and the latter because of the appointment of a book review editor and increased expenses associated with the sharp rise in the number of manuscripts, journals, and books handled.

Budgeted expenditures for 1967 were $109,845, while actual expenditures were $112,209.84. The difference is traced partly to higher printing and mailing costs; my budgeted expenditure for this item was based on an estimate of 98,000 copies of the *Review* for the year and 420 pages per copy, but the actual number of copies was 99,000 and the actual number of pages per copy was 444. Payments also exceeded the estimate because of the large increase in number of papers published during the year. Finally, office expenditures were also higher than budgeted by about $1,400, which reflected increased clerical help and a jump in postage and supplies expenses arising from the greater number of manuscripts handled during the year.

The 1968 budget shows printing and mailing costs at $90,000, over $7,000 higher than actual costs in 1967. This 1968 figure is based on estimates of 106,000 copies of 444 pages per copy, and it reflects an increase in basic printing prices. The budget also shows about a $1,600 increase over 1967 for office expenses, which anticipates increased expenses of handling the ever increasing flow of manuscripts, book reviews, and correspondence.

TABLE 5

ACTUAL AND BUDGETED EXPENDITURES, 1963–67

	Actual Expenditures					Budget	
	1963	1964	1965	1966	1967	1967	1968
Printing and mailing	$51,644.09	$53,660.84	$61,606.82	$74,277.93*	$82,840.41	$82,320.00†	$90,000.00‡
Payments to contributors	2,308.00	1,424.50	1,598.00	1,873.50	2,255.00	1,800.00	2,000.00
Subtotal	$53,952.09	$55,085.34	$63,204.82	$76,151.43	$85,095.41	$84,120.00	$89,842.00
Office Expenses							
Editor's salary	$ 8,000.00	$ 8,000.00	$ 9,000.00	$ 9,000.00	$ 9,000.00	$ 9,000.00	$ 9,000.00
Editorial assistance	9,702.06	13,460.06	12,024.08	14,189.83	16,218.65	15,125.00	17,246.00
Assistant to editor	6,234.44	6,619.32	6,619.32	7,330.00	8,025.00	8,025.00	8,426.00
Book reviews	—	1,833.32	2,000.00	2,000.00	2,000.00	2,000.00	2,100.00
Secretarial	1,442.25	1,632.75	1,725.00	2,160.15	2,400.00	2,400.00	2,520.00
Clerical, proofreading, etc.	2,025.37	3,374.67	1,679.76	2,699.68	3,793.65	2,700.00	4,200.00
Postage and supplies	1,165.50	1,348.23	1,462.32	1,479.61	1,895.78	1,500.00	2,280.00
Office equipment	812.63	122.07	—	175.50	—	100.00	100.00
Subtotal	$19,680.19	$22,930.36	$22,486.40	$24,844.94	$27,114.43	$25,725.00	$28,626.00
Total	$73,632.28	$78,015.70	$85,691.22	$100,996.37	$112,209.84	$109,845.00	$120,626.00

* Corrected figure.
† Based on estimated copies of 98,000 and 420 pages per copy.
‡ Based on estimated copies of 106,000 and 444 pages per copy.

Table 6 gives detailed information about printing and mailing costs by issues during 1967. The number of copies printed in 1967 averaged 24,750 per issue compared to 22,691 the year before and to 20,400 in 1965. Ten years ago, the figure was only 12,400. The successive increases are of course mainly related to the increases in membership and subscriptions.

TABLE 6

COPIES PRINTED, SIZE AND COST OF PRINTING AND MAILING IN 1967

	Printed	Pages		Cost		
		Net	Gross	Issue	Reprints	Total
March	24,500	363	456	$21,079.39	$219.00	$21,298.39
June	24,500	368	420	19,348.12	140.34	19,488.46
September	25,000	341	416	19,253.91	103.83	19,357.74
December	25,000	393	484	22,526.03	169.79	22,695.82
	99,000	1,465	1,776	$82,207.45	$632.96	$82,840.41

During the year I have had the advice and assistance of the following foreign correspondents, who have been particularly helpful with regard to the selection of foreign books for listing and review:

Maurice Flamant (France)
Erich Schneider (Germany)

Three members of the Board of Editors complete their three-year terms of office at this time: William Baumol, James Buchanan, and Richard Easterlin. The Association owes them a heavy debt of gratitude for the generous expenditure of time they have made in the interests of the *Review*, and I very much appreciate their constant willingness, even when other obligations pressed, to review manuscripts and offer editorial advice. I nominate as their successors on the Board, for three-year terms beginning in 1968: Gary Becker, Irwin Friend, and Warren Smith.

During the year I have frequently sought the aid of members of the profession in addition to the members of the Editorial Board—partly to relieve the latter of what would otherwise be an impossibly heavy burden and partly to obtain advice of specialists in particular areas not represented on the Board. The following have assisted in this way:

F. Adams	B. Balassa	G. Break	E. Budd
I. Adelman	R. Baldwin	H. Brems	J. Burns
M. Adelman	D. Bear	J. Brittain	M. Burstein
A. Alchian	G. Becker	M. Bronfen-	P. Cagan
D. Alhadeff	A. Bergson	brenner	R. Campbell
K. Arrow	J. Blackburn	E. Brown	D. Cass
G. Bach	R. Bodkin	H. Bruton	R. Caves
M. Bailey	R. Brandis	W. Bryan	R. Coen

JOURNAL OF ECONOMIC ABSTRACTS

REPORT OF THE MANAGING EDITOR FOR THE YEAR
ENDING NOVEMBER 30, 1967

Since the *Journal of Economic Abstracts* is about to enter a third phase of its existence, a brief review of its life to date seems in order.

The first issue of the *Journal* appeared in January, 1963, and was financed by a modest grant from the Ford Foundation. Its prospects of survival then appeared dependent on the ability of the *Journal* to finance itself through individual subscriptions. Since the size of the market was never likely to be very large, it appeared necessary to conduct a very low-cost operation.

The question of cost had an important bearing on editorial policy. In particular, the main responsibility for abstracts was placed on the editors of contributing journals, and they in turn were to obtain abstracts from authors. The Editor of the *Journal* did not assume responsibility for the content of the abstracts. The *Journal* is different from many other abstracting operations which either prepare or review abstracts. Such an operation would require an office and a full-time staff and extensive correspondence with reviewers in specialized fields.

Over the years, the contributing editors have not performed as well as they might. Apparently, they have generally forwarded abstracts from individual contributors, with little review or editing on their part. They do not seem to have taken the point of view that the reputation of their own *Journal* might depend in some way on the quality of their abstracts.

Some questions have been raised about the practice of having individual authors prepare their own abstracts on the grounds that they claim too much for their products. On the other hand, it can be argued that the *Journal of Economic Abstracts* does not intend to produce a definitive appraisal of an article, but it does give an author an opportunity to advertise his product. He may gain some readers that he does not deserve; but he may also rescue an article that may otherwise be ignored.

The taking over of the *Journal* by the American Economic Association at the end of 1965 removed all financial problems and permitted a large expansion of the *Journal*, in accordance with the desires of the Executive Committee. This expansion has involved both benefits and costs—the benefits are obvious; the costs involve a reduction in the quality of the articles. In other respects, editorial policy and practices have remained what they were in the period of severe financial constraints.

During the next phase, the Executive Committee will presumably decide whether to make radical revisions in previous policies. This, again, will involve questions of benefits and costs. If abstracts are to become authoritative appraisals and reviews, costs will inevitably rise very sharply. The question that has to be answered is whether benefits will rise equally sharply.

One change that needs to be made is coordination of the *Journal of Economic Abstracts* with the *Index*. No index of the *Journal* has been published for the last two years on the grounds that the Association already publishes an index. Also, it did not seem to make sense to index articles that were merely listed. At the same time, it would look awkward to index only articles that were abstracted. The obvious solution is to synchronize the *Journal of Economic Abstracts* with the *Index*, without undue delay in publication of the abstracts.

Journals added on a total or occasional basis during 1967 are:

Agricultural Economics Research
De Economist
Federal Reserve Bulletin
Giornale degli Economisti e Annali di Economia
Il Politico
Industrial and Labor Relations Review
Journal of Human Resources
Journal of Marketing Research
Monthly Labor Review
MSU Business Topics
National Tax Journal
New Zealand Economic Studies
Peace Research Society (International)
Public Finance
Schmoller's Jahrbuch für Gesetzgebung, Verwoltung und Volkswirtschaft
Social and Economic Administration
Social Research
Southwestern Social Science Quarterly
Survey of Current Business

Journals whose requests have been rejected during the same period are:

American Journal of Economics and Sociology
The Appalachian Financial Review
Artha Vijnana
Bulletin of Business Research
Comercio Exterior

Expenses of the Editorial Office for the year, November 30, 1966, to November 30, 1967, were:

Editor's salary..........................	$1,500.00
Assistant editor's salary.................	775.00
Secretarial..............................	500.00
Postage, telephone, supplies..............	60.00
	$2,835.00

The budget requested for December 1, 1967, to November 30, 1968, is:

Editor's salary.........................	$1,500.00
Assistant editor's salary.................	1,000.00
Secretarial.............................	500.00
Postage, telephone, supplies..............	60.00
	$3,060.00

ARTHUR SMITHIES, *Managing Editor*

REPORT ON INDEXING OF ARTICLES IN COLLECTIVE VOLUMES

The American Economic Association has published seven volumes of the *Index of Economic Journals* covering the period from 1889 through 1965. After the publication of the volume for 1964–65, a decision was made by the A.E.A. Executive Committee to extend the coverage of the index to articles which appeared in collective volumes such as conference volumes, *Festschriften*, and other specialized volumes of articles. John Miller, at Yale, had undertaken the responsibility for the *Index of Economic Journals*, but with the decision to undertake the indexing of articles in collective volumes he felt that he could no longer continue as chairman of this project. In his stead, Richard Ruggles was asked to continue this work.

A preliminary discussion of the proposed index of articles in collective volumes was held at the December, 1966, A.E.A. Executive Committee meeting, and at that time $2,500 was authorized for exploratory work to determine the dimensions of the task and the budget requirements. In March, 1967, a preliminary report was made which suggested on the basis of a survey that articles in collective volumes would perhaps be almost as numerous as the articles which appeared in the indexed journals. At that time, it was proposed that an index of articles in collective volumes should be prepared for the period through 1965 and as far back as would conveniently fill one volume. It was also estimated that the cost of indexing an article would be somewhat higher than previously, because of the difficulty of obtaining the original material, and would probably cost somewhere in the neighborhood of $1.75 per item indexed. On the basis of this budget request, a further grant of $7,500 was made to carry the work through December, 1967. This rate of expenditure was considerably less than the previous rate, but it was felt that in light of the exploratory nature of the work it was advisable to proceed somewhat more slowly.

Classification Done during 1967

Initially, books published in the period from 1960 to 1965 were collected and articles appearing in them were classified. As the work progressed, however, it became evident that there would be sufficient articles in collective volumes for the years 1964–65 to produce a separate volume for these years. Such a solution would be desirable since it would match the 1964–65 *Index of Economic Journals*, and could be brought out more quickly. Once this decision was made, the major effort was focused on the 1964–65 period. Thus far, over 500 books containing economic articles have been processed. The breakdown by period is: 1960–63, 2,000 articles; 1964–65, 4,500 articles; total, 6,500 articles. The publication of the 1964–65 index would require a volume of approximately 300 pages.

The collective volumes consisted of the following types of works: *Festschriften*; conference reports with individual papers; collected essays,

original, or one or more authors; collected essays, reprinted, of one author, indexing only those not before processed in the *Index of Economic Journals;* readings in a special field of economics if the book contains articles reprinted in their entirety or if the field is quite narrow; some lecture series; hearings, readings, and studies for congressional committees; some similar material for Canada; translations into English of foreign articles and essays.

Expenditures for 1967 and Projected Budget

The expenditures from November 20, 1966, to November 30, 1967, together with the projected budget to March 1, 1968, are shown below:

	Expenditures November 20, 1966, to November 30, 1967	Budget December 1, 1967, to March 1, 1968	Total
Salaries			
Director..........................	$6,000	$1,700	$ 7,700
Assistant..........................	1,700	500	2,200
Proofreading.......................		400	400
Postage, supplies and microfilming......	50		50
Contribution to Yale for use of library room and library services............	400		400
Total..........................	$8,150	$2,600	$10,750
Cost per article for processing 6,500 articles 1960–65....................	$1.25		
Cost of final processing required for 4,500 articles 1964–65..............		$ .58	

The cost to date of processing the 6,500 articles from collective volumes has come to approximately $8,150, and has therefore cost approximately $1.25 per article. A few more collective volumes which have been requested from the publishers and from other sources will come in, but the point has now been reached where further attempts to get more complete coverage would result in costs which would be too high to be justified. The work which remains involves preparing the material on hand for the printer and proofreading it to eliminate as many errors as possible. It is anticipated that the volume could be sent to the printer by March 1, 1968, and that the additional work will raise the cost per article to approximately $1.85. Approximately $1,000 more than the budgeted amount will be required to carry the project through. The original estimate for the volume was $14,000, of which $10,000 was actually budgeted. The lower cost of the volume is due to its reduced size; an even lower cost would have resulted if classification work on books published from 1960–63 had not been done.

Considerations Relating to Future Volumes

Although it would be desirable to go back and finish the indexing of articles in collective volumes for the period 1960–63, it would seem that the literature for the years 1966 and 1967 should have high priority. Estimates

for the number of books, journal articles, and other articles which would need to be classified are shown below.

	Actual 1965	Estimated		Total 1966–67
		1966	1967	
Books.......................	1,600	2,000	2,100	4,100
Journal articles.............	2,500	2,700	2,800	5,500
Other articles..............	2,250	2,500	2,600	5,100
	6,350	7,200	7,500	14,700

There are of course several strategic decisions which need to be made. Future indexes could cover only a part of the economic literature, or yearly volumes could be published covering all of the economic literature for a given year. Yearly volumes would result in somewhere around 7,500 articles per volume, and would produce volumes similar in size to that of 1960–63, which contained approximately 550 pages. Individual volumes of indexes of books or journal articles or articles in collective volumes could be published for the period 1966–67, and the volumes would be approximately the same size as the 1964–65 volume of 350 pages.

The cost figures of somewhere between $1.50 and $2.00 an article seem to be an appropriate basis for making budget estimates. Articles in collective volumes and books cost about 20 percent more to index than articles appearing in journals.

If a decision were made to index all the economic literature for 1966 and 1967, the rate of expenditure would have to be increased from the present level of $10,000 a year, or else the indexing work would fall further in arrears. The total cost of doing 1966 and 1967 for all literature would be between $25,000 and $30,000. If only journal articles are to be indexed, this could be accomplished in the time period of one year for approximately $10,000.

RICHARD RUGGLES

REPORT OF THE COMMITTEE ON CLASSIFICATION

Summary of Recommendations

The Committee on Classifications submits the following recommendations.

1. A single system of classification should be developed for all of the indexing and classification activities of the American Economic Association. The single classification system should have different levels of classification, so that it can adequately serve for (a) the listing of current economic literature, (b) the cumulative indexing of economic literature, and (c) the listing of economic specialties for the A.E.A. *Handbook* and the National Register of Scientific and Technical Personnel.

2. The American Economic Association should coordinate its bibliographical and biographical listing and indexing work in order to reduce the duplication of effort and improve consistency among the related efforts.

3. The scope of the bibliographical indexing and classification should be extended to cover all economic literature contained in the major journals, books, and collective volumes.

4. The classifying and indexing of economic literature and of biographical information should be computerized in order to lower the cost of processing, reduce error, increase the amount of cross-classification, and provide more comprehensive cumulative indexes of bibliographical and biographical information.

5. In order to implement the above objectives, a research and development project should be undertaken which will permit the introduction of a new classification system and computerization in the foreseeable future. The research and development project should be aimed at the creation of an integrated, coordinated, and mechanized system of classifying and indexing all bibliographical and biographical information of concern to the American Economic Association.

Economic Classification Systems for Bibliographical and Biographical Indexing

A.E.A. Classification Systems in Current Use. At the present time, the American Economic Association uses three different classification systems. A preliminary report comparing these different classification systems was submitted to the Executive Committee in March of 1967. Although the three systems are highly interrelated, they differ from each other in important aspects. The classification used for the listing of current economic literature and economic abstracts consists of 16 broad classifications, with no breakdown within these classifications; the classification system used by the *Index of Economic Journals* is based upon 23 broad classifications and over 700 subclassifications; and the classification system used for the A.E.A. *Handbook* and for the National Register, although similar in broad groups to the classification system used for current literature, has important

differences in the categories of economic theory, economic history, and economic development, and the *Handbook* classification contains in addition 46 subclassifications.

The Possibility of a Single Classification System. It is obvious that the different classification activities require different levels of detail. The classification of current economic literature requires the smallest number of classification categories. It seems apparent, however, that the 16 categories which are currently used are inadequate and result in listing a large number of quite different articles and books under a single general heading. There was general agreement by the Committee that an effort should be made to devise a more detailed classification system for the current literature. The amount of detail required for the cumulative index of economic literature is much larger. The Committee did not explore at this time the question of precisely what the order of magnitude of classification should be for this purpose. Although as suggested in the March, 1967, preliminary report, the system in current use may be somewhat overdetailed in some areas; it may need to be expanded in other areas where there is a large amount of economic literature. Finally, with respect to the *Handbook* and the National Register, the amount of detail provided by the present classification system seems to be quite appropriate, although it was recognized that some changes in the classification system were needed to take account of changes in the focus of economics and the current training and research interests of economists.

The Proposed Single Classification System. The Classification Committee considered at some length the possibility of creating a four-level classification system which could meet all of the A.E.A. classification needs. In particular, attention was directed to the question of whether it was possible to reconcile the classification system required for the listing of current economic literature with that used for the *Handbook* and the National Register.

As a result of these discussions, the Committee drew up a three-level system which could reconcile these classification needs. This system provided 47 classifications for the listing of current literature and 95 for the list of economic specialties. The three-level system together with the specific classification systems used for these two purposes are shown in Appendix A.

It was recognized by the Committee that a fourth level of detail would be required for the cumulative index of economic literature. Although the Committee was certain that a fourth-level classification system could be constructed which would serve this purpose, there was general agreement that such an effort should be based upon careful analysis and study of the present classification system used for the *Index of Economic Journals.* The process of developing the fourth level of classification, furthermore, should not be undertaken except as part of a larger program of research and development on the whole problem of bibliographical and biographical indexing. No effort should be made to change the present classification used for the *Index* until such time as a new classification system has been fully developed and tested. This suggests that the present classification system

used by the *Index* should be retained for the cumulative volume of the index of economic literature covering the years 1966 and 1967.

The Need for Coordination Activities

The Existing Situation. At the present time the various classification and indexing activities of the American Economic Association are quite independent of one another. The classification of books received and articles appearing in current journals is done at Stanford and sent to Cambridge where economic abstracts which are received from cooperating journals are added and prepared for publication in the *Journal of Economic Abstracts*. The cumulative indexing of economic journals and more recently the indexing of collective volumes is done in New Haven. Although the previously published listings of articles and books are used as part of the bibliographical input to the cumulative index, each article is reexamined and reclassified according to a different classification system. Finally, the information for the A.E.A. *Handbook* is obtained on a questionnaire basis directly from A.E.A. members. Each member classifies himself in terms of a specified list of specialties and this material together with some bibliographical information about the major writings of the member are processed and prepared for publication in Evanston.

Possible Patterns of Coordination. At present there is considerable duplication of effort since the work done in the initial classification and listing is not utilized in the subsequent bibliographical and biographical indexing. This situation is due in part to the differences in classification systems and processing procedures used by the different groups and in part to the failure to develop a coordinated effort.

It would be feasible to develop a system whereby the classification of current economic literature would not need to be redone for the later cumulative indexes. Similarly, since the index of economic literature would provide bibliographical information by author it should be possible to integrate within it the additional bibliographical information provided by A.E.A. members. It would therefore be possible to eliminate duplicate coverage in the *Handbook*.

Such coordination, however, requires the adoption of a single classification system. Current economic literature would have to be classified at the detailed level so that it could be integrated directly into the later cumulative indexing. This does not mean, however, that the published listing of current economic literature need be at the most detailed level of classification. Since the classification system is a telescoping one, the current economic literature can be listed at less detailed levels of classifications.

It may, of course, be desirable for the coverage of the cumulative index to be broader than that of the current listing of economic literature. However, such extension of coverage is much less costly than redoing the job completely, since the current economic literature will constitute the bulk of the cumulative index. Approximately 70 to 80 percent of the items now appearing in the *Index of Economic Journals* have previously been shown in the list of current economic literature.

With respect to the bibliographical material now published in the A.E.A.

Handbook, it may be felt desirable for members to have an opportunity to list their major publications but it seems reasonable that this material should be transferred in the index of economic literature where it would be shown under both the subject and the author classifications. The coordination of all of these efforts would both reduce the amount of resources required to carry out the classification effort and provide more comprehensive and consistent coverage.

Scope and Coverage

Present Scope of Classification Activities. At the present time the scope and coverage of the classification activities for books, current economic literature, economic abstracts, *Index of Economic Journals,* and the A.E.A. *Handbook* differ widely. These differences are quite intentional and in most cases quite justified.

The list of books in the current listing of economic literature depends entirely upon the receipt of books by the American Economic Association. Since most publishers are aware of the desirability of having their books listed by the American Economic Association, it is customary for publishers to send copies and to hope that their books will not only be listed but also reviewed.

The periodical listing covers a specific set of journals in which it is expected that most of the core economic literature will appear. All articles are reported for the major economic journals. For journals less directly related to economics selected articles are listed.

Economic abstracts depend upon the establishment of a formal relationship between specific journals and the *Journal of Economic Abstracts.* At the present time approximately fifty journals send abstracts to the *Journal of Economic Abstracts.* In the case of some journals only selected articles are abstracted.

The *Index of Economic Journals* has in the past attempted to cover a broader area than any of the other indexing activities. More recently the indexing of economic literature has been extended to articles which appear in collective volumes such as proceedings of conferences and *Festschriften.*

Finally, the A.E.A. *Handbook* covers A.E.A. members and the bibliography relates to only those items which are selected by the members as their most important writings.

Possible Changes in the Scope of Coverage. There are important limitations to the expansion in the scope and coverage of current literature reporting. If the listings of current literature are to be timely, they must be done promptly with a minimum of effort. It is fairly easy to define a major core of economic literature which can be covered systematically and quickly. The attempt to obtain coverage beyond this core becomes more difficult and time consuming. The present scope and coverage of current literature reporting appears to represent an appropriate solution.

Although the coverage of economic abstracts is and should be substantially smaller than the listing of current economic literature, it is less clear just where the lines should be drawn. It would be a disservice to the pro-

fession to expand the number of economic abstracts to the point where large amounts of material peripheral to economics or economics articles from lower quality or popular journals were introduced in great number. In line with this reasoning it would seem that the coverage of economic abstracts should be confined to providing information on the core of economic literature.

With respect to cumulative indexes of economic literature, however, it does seem appropriate that the scope should be broadened and the coverage made more complete. As already noted, the *Index of Economic Journals* included about 30 percent more articles than the current listing of economic articles, but it is not possible to determine the degree of coverage of the index in any absolute terms.

The difficulty in obtaining comprehensive coverage from known published sources strongly suggests that costs of obtaining information on fugitive economic literature may be quite high if pursued by traditional library techniques. A great deal of bibliographical research would be required and many books and periodicals would have to be scanned. In many cases where the title is not informative the literature itself would have to be read. It does not seem unreasonable that improved coverage at lower cost might be achieved by obtaining bibliographical information directly from authors.

The Potential of Mechanization of Classification Procedures

The Coordination of Different Processing Stages. Unless the classification and indexing procedures are mechanized, much of the advantage of coordination among the different classification activities will be lost. If it is necessary to recopy from the current lists of economic literature the titles, authors, and sources of books and articles together with their classification numbers, the clerical work load will still be quite substantial. It is not enough merely to transfer the intellectual decisions with respect to classification. A mechanized method should be provided so that the physical task of recording the basic information does not have to be repeated. A mechanized system which puts the basic information into machine readable form would reduce the cost of processing considerably for later stages. If the basic information is in machine readable form, cumulative listings can be obtained mechanically by combining the different sets of current listings. Furthermore, items can be arranged in terms of more detailed levels of classification by making use of the additional classification digits. Author indexes can be obtained automatically by rearranging the listings. Such computer processing and manipulation not only reduces cost of handling substantially but it minimizes errors resulting from copying, misfiling, or omission.

Potential Improvements in Classification Procedures. Besides reducing costs, mechanization can also improve the quality of classification and indexing. With hand processing methods the amount of cross-classification which is feasible for any bibliographical item is severely limited, since for each cross-classification it is necessary to provide a separate entry which

can be physically inserted in the file at the appropriate classifications. With a computerized system the bibliographical item needs to be entered only once and it can be tagged with any number of descriptions desired. The computer can then reproduce the item under the appropriate classifications. The ability of the computer to link bibliographical and biographical information, furthermore, means that the mechanization can provide a feedback system whereby at periodic intervals bibliographical records are sent directly to authors for their verification. Authors can then make any corrections or additions they desire, thus improving the quality and coverage of the cumulative bibliographical and biographical indexes.

Proposed Development of an Integrated and Mechanized System for A.E.A. Classification Activities

The Flow of Bibliographical and Biographical Information. The flow of biographical and bibliographical information can be mechanized and processed so that it can: provide current listings of economic literature and economic abstracts; supply lists of economists who would be appropriate for reviewing specific books; establish a feedback mechanism on information entering the system, so that it can be corrected by authors; develop a periodic reporting system by economists; produce a cumulative index of economic literature; and list biographical information on economists. It should be possible, given the existence of such a cumulative bibliographical file, to produce special bibliographies on given topics or to provide curriculum vitae and bibliographies of economists in different fields of work.

Requirements for an Integrated Mechanized System. There are, of course, a number of requirements which must be met if an integrated mechanized system of classification is to be developed. First, as has already been recommended, a single classification system is needed which can provide a number of levels of classification for different purposes. Second, it would be necessary to computerize the operation. Without computerization handling the flow of information, processing it systematically and making it available at low cost would not be feasible. Third, coordination of existing A.E.A. classification activities is required. Finally, it will be necessary to establish a set of central cumulative files which can be continuously updated by the inflow of information and which can serve as a repository for data and provide the basis for communication with the profession.

Since the creation of an integrated and mechanized bibliographical and biographical indexing system involves a considerable number of highly related developments, it is recommended that a pilot project be undertaken to develop a single classification system and test it on a body of economic literature and to design and implement a mechanized system for classifying data and processing. A cumulative file of bibliographical and biographical data should be established to provide the basis for the feedback mechanism between the system and the economics profession. Without such a mechanized cumulative bibliographical and biographical file, the updating and correcting features of the system cannot be put into operation.

The Committee was strong in its belief that this development of an

integrated system should be carried on as a separate activity in the current period and that the present hand-operated classification procedures should not be abandoned until such time as the new system has proved its ability and can perform without interruption. This suggests that the two efforts should be expected to run in parallel for the next two or three years until there is full assurance that the newly integrated and mechanized system can in fact carry out its function.

RICHARD H. LEFTWICH

APPENDIX

RECOMMENDED SYSTEMS OF ECONOMIC CLASSIFICATION

Three Levels of Economic Classifications

000 General economics; Theory; History; Systems
   010 General economics
       011 General economics
   020 General economic theory
       021 General equilibrium theory
       022 Microeconomic theory
       023 Macroeconomic theory
       024 Welfare theory
   030 History of thought; methodology
       031 History of economic thought
       032 Economic methodology
   040 Economic history
       041 Economic history
   050 Economic systems
       051 Capitalist economic systems
       052 Socialist and communist economic systems
       053 Comparative economic systems
   090 Other
       099 Other (specify)

100 Economic growth; Development; Planning; Fluctuations
   110 Economic growth, development, and planning theory and policy
       111 Economic growth and development theory
       112 Economic planning theory and policy
       113 Economics of war and defense
   120 Economic development studies
       121 Economic development studies of less developed countries
       122 Economic development studies of developed countries
       123 Comparative economic development studies
   130 Economic fluctuations and forecasting
       131 Economic fluctuations and stabilization
       132 Economic forecasting and forecasting models
   190 Other
       199 Other (specify)

200 Economic statistics
   210 Econometric and statistical methods
       211 Econometric methods
       212 Statistical methods
   220 Economic and social accounting
       221 National income accounting
       222 Input-output
       223 Financial accounts
       224 National wealth and balance sheets
       225 Social indicators and accounts
   290 Other
       299 Other (specify)

300 *Monetary and fiscal theory and institutions*
    310 Monetary and financial theory and institutions
        311 Monetary theory and policy
        312 Commercial banking
        313 Financial markets
        314 Financial intermediaries
    320 Fiscal policy and public finance·
        321 Fiscal theory and policy
        322 Government expenditures and budgeting
        323 Taxation
        324 State and local finance
    390 Other
        399 Other (specify)

400 *International economics*
    410 International trade theory
        411 International trade theory
    420 Trade relations; commercial policy; economic integration
        421 Trade relations
        422 Commercial policy
        423 Economic integration
    430 Balance of payments; international finance
        431 Balance of payments; exchange rates
        432 International monetary arrangements
    440 International investment and foreign aid
        441 International investment and foreign aid
    490 Other
        499 Other (specify)

500 *Administration; Business finance; Marketing; Accounting*
    510 Administration
        511 Organization and decision theory
        512 Managerial economics
        513 Business and public administration
    520 Business finance and investment
        521 Business finance
        522 Business investment
    530 Insurance
        531 Insurance
    540 Marketing
        541 Marketing
    550 Accounting
        551 Accounting
    590 Other
        599 Other (specify)

600 *Industrial organization; Technological change; Industry studies*
    610 Industrial organization and public policy
        611 Industrial organization and market structure
        612 Public policy towards monopoly and competition
        613 Public utilities and government regulation of the private sector
        614 Public enterprises
        615 Economics of transportation
    620 Economics of technological change
        621 Technological change; innovation; research and development
    630 Industry studies
        631 Industry studies: manufacturing
        632 Industry studies: extractive industries
        633 Industry studies: distributive trades
        634 Industry studies: construction
        635 Industry studies: services and other
    690 Other
        699 Other (specify)

700 Agriculture; Natural resources
  710 Agriculture
      711 Agricultural demand and supply analysis
      712 Agricultural situation and outlook
      713 Agricultural policy
      714 Agricultural finance
      715 Agricultural marketing
      716 Farm management
      717 Land reform
  720 Natural resources
      721 Natural resources and conservation
  790 Other
      799 Other (specify)

800 Manpower; Labor; Population
  810 Manpower training and development
      811 Manpower training and development
  820 Labor markets; public policy
      821 Theory of labor markets
      822 Public policy; role of government
      823 Labor mobility; migration
      824 Labor market studies, wages, employment
  830 Trade unions; collective bargaining; labor-management relations
      831 Trade unions; collective bargaining; labor-management relations
  840 Population
      841 Population
  890 Other
      899 Other (specify)

900 Welfare programs; Consumer economics; Urban and regional economics
  910 Welfare programs
      911 General welfare programs
      912 Economics of education
      913 Economics of health
      914 Economics of poverty
      915 Social security
  920 Consumer economics
      921 Consumer economics; levels and standards of living
  930 Urban economics
      931 Urban economics and public policy
      932 Housing economics
      933 Urban transportation economics
  940 Regional economics
      941 Regional economics
  990 Other
      999 Other (specify)

ECONOMICS SPECIALTIES LIST
FOR USE WITH
NATIONAL REGISTER OF SCIENTIFIC AND TECHNICAL PERSONNEL

General economics; Theory; History; Systems
  9011 General economics
  9021 General equilibrium theory
  9022 Microeconomic theory
  9023 Macroeconomic theory
  9024 Welfare theory
  9031 History of economic thought
  9032 Economic methodology
  9041 Economic history
  9051 Capitalist economic systems
  9052 Socialist and communist economic systems
  9053 Comparative economic systems
  9099 Other (specify)

Economic growth; Development; Planning; Fluctuations
  9111 Economic growth and development theory
  9112 Economic planning theory and policy
  9113 Economics of war and defense
  9121 Economic development studies of less developed countries
  9122 Economic development studies of developed countries
  9123 Comparative economic development studies
  9131 Economic fluctuations and stabilization
  9132 Economic forecasting and forecasting models
  9199 Other (specify)

Economic statistics
  9211 Econometric methods
  9212 Statistical methods
  9221 National income accounting
  9222 Input-output
  9223 Financial accounts
  9224 National wealth and balance sheets
  9225 Social indicators and accounts
  9299 Other (specify)

Monetary and fiscal theory and institutions
  9311 Monetary theory and policy
  9312 Commercial banking
  9313 Financial markets
  9314 Financial intermediaries
  9321 Fiscal theory and policy
  9322 Government expenditures and budgeting
  9323 Taxation
  9324 State and local finance
  9399 Other (specify)

International economics
  9411 International trade theory
  9421 Trade relations
  9422 Commercial policy
  9423 Economic integration
  9431 Balance of payments; exchange rates
  9432 International monetary arrangements
  9441 International investment and foreign aid
  9499 Other (specify)

Administration; Business finance; Marketing; Accounting
  9511 Organization and decision theory
  9512 Managerial economics
  9513 Business and public administration
  9521 Business finance
  9522 Business investment
  9531 Insurance
  9541 Marketing
  9551 Accounting
  9599 Other (specify)

Industrial organization; Technological change; Industry studies
  9611 Industrial organization and market structure
  9612 Public policy towards monopoly and competition
  9613 Public utilities and government regulation of the private sector
  9614 Public enterprises
  9615 Economics of transportation
  9621 Technological change; innovation; research and development
  9631 Industry studies: manufacturing
  9632 Industry studies: extractive industries
  9633 Industry studies: distributive trades
  9634 Industry studies: construction

9635 Industry studies: services and other
9699 Other (specify)

Agriculture; Natural resources

9711 Agricultural demand and supply analysis
9712 Agricultural situation and outlook
9713 Agricultural policy
9714 Agricultural finance
9715 Agricultural marketing
9716 Farm management
9717 Land reform
9721 Natural resources and conservation
9799 Other (specify)

Manpower; Labor; Population

9811 Manpower training and development
9821 Theory of labor markets
9822 Public policy; role of government
9823 Labor mobility; migration
9824 Labor market studies; wages; employment
9831 Trade unions; collective bargaining; labor-management relations
9841 Population
9899 Other (specify)

Welfare programs; Consumer economics; Urban and regional economics

9911 General welfare programs
9912 Economics of education
9913 Economics of health
9914 Economics of poverty
9915 Social security
9921 Consumer economics; levels and standards of living
9931 Urban economics and public policy
9932 Housing economics
9933 Urban transportation economics
9941 Regional economics
9999 Other (specify)

XX05 Education
XX26 Public administration
XX29 Teaching of economics

Classification System for Current Economic Literature

General economics; Theory; History; Systems

01 General economics
02 General economic theory
03 History of thought; methodology
04 Economic history
05 Economic systems
09 Other

Economic growth; Development; Planning; Fluctuations

11 Economic growth, development, and planning theory and policy
12 Economic development studies
13 Economic fluctuations and forecasting
19 Other

Economic statistics

21 Econometric and statistical methods
22 Economic and social accounting
29 Other

Monetary and fiscal theory and institutions

31 Monetary and financial theory and institutions
32 Fiscal policy and public finance
39 Other

International economics

    41 International trade theory
    42 Trade relations; commercial policy; economic integration
    43 Balance of payments; international finance
    44 International investment and foreign aid
    49 Other

Administration; Business finance; Marketing; Accounting

    51 Administration
    52 Business finance and investment
    53 Insurance
    54 Marketing
    55 Accounting
    59 Other

Industrial organization; Technological change; Industry studies

    61 Industrial organization and public policy
    62 Economics of technological change
    63 Industry studies
    69 Other

Agriculture; Natural resources

    71 Agriculture
    72 Natural resources
    79 Other

Manpower; Labor; Population

    81 Manpower training and development
    82 Labor markets; public policy
    83 Trade unions; collective bargaining; labor-management relations
    84 Population
    89 Other

Welfare programs; Consumer economics; Urban and regional economics

    91 Welfare programs
    92 Consumer economics
    93 Urban economics
    94 Regional economics
    99 Other

REPORT OF COMMITTEE ON ECONOMIC EDUCATION

The main aim of this Committee during 1967 has been to stimulate experimentation with different means of teaching (especially at the level of the elementary course), coupled with careful evaluation and measurement of results so that information can be effectively transmitted to other institutions. We are convinced that this is one important way in which the profession can make further progress toward improving the efficiency of teaching in economics. This attempt has involved several lines of activity.

Last year we suggested to the Joint Council on Economic Education the formation of a special task force, with membership to be suggested by the Association, to prepare tests of understanding of economics at the collegiate level. The primary objective is to provide tests that will both help individual schools assess their results and permit cross-comparison of results of different teaching approaches and different institutions. This task force, under the chairmanship of Professor Rendigs Fels, has completed two forms of a test covering a standard course in macroeconomics and has nearly completed comparable forms for a standard course stressing microeconomics. These examination questions are being pretested through the Psychological Corporation, with the aid of many members of the economics profession throughout the country. The macro exams are available from the Psychological Corporation (304 East 45th Street, New York, New York, 10017); the micro exams will be available this summer. We hope the profession will make wide use of these tests; and that performance records on the standardized tests will be made available to this Committee. We expect to continue our push toward analyses of alternative teaching methods, with subsequent reports to the profession.

The Committee has continued to work with the Joint Council on Economic Education on five special projects, aimed at implementing the broad objective above: (1) A national study to evaluate the effectiveness of programmed learning in teaching economics at the college level has been commissioned and should be completed by next summer. It is under the direction of Professors Richard Attiyeh, G. L. Bach, and Keith Lumsden, and will involve a sample of some 6,000 students at about sixty institutions throughout the country. (2) The University of Michigan is conducting a special analysis of the effectiveness of small-group teaching compared to larger section sizes. (3) A project at San Jose State is attempting to utilize the results of some high school experimentation with a special course in economics to construct a comparable course, at a higher level, for college students. (4) The Committee and the J.C.E.E. are planning a study of substantial size on the lasting effects of college elementary courses; preliminary work on this project is being done by Professor Phillip Saunders. (5) The Committee and the J.C.E.E. are attempting to stimulate the development of a few basic courses at colleges and universities which can be evaluated carefully and made available to junior colleges and those institutions which

lack enough trained economists to do the developmental work themselves.

The J.C.E.E., with the advice and counsel of the Committee, is exploring the possibility of establishing a journal of economic education. The purpose would be to improve the information flow on experiments and alternative approaches to the teaching of economics, primarily at the college level. Such a journal might provide an outlet for reports on special studies of courses and units within courses, or other interesting teaching experiments and results, that seem to merit dissemination. Our goal is to extend substantially the half-life of worthwhile experiments at different institutions on which there is presently no effective means of disseminating information.

Over the past two years, the Committee has worked with the J.C.E.E. to encourage the preparation of a series of small monographs on economics to supplement regular teaching materials in the high schools. There will be four such units (on micro- and macroeconomics) for use in the universally required American history course, and five small monographs (on different central areas of economics) for use in senior level courses in "Problems of Democracy," civics, and the like. Each unit is being prepared by a distinguished economist, and we hope they will be completed by next year. Each author has the assistance of a high school teacher or supervisor and each will be classroom tested before being released by the Joint Council on Economic Education.

The Visiting Scientists Program in economics, for which the Association has received grants from the National Science Foundation over the past two years, has flourished. Professor Phillip Saunders, who is administering the program for the Committee, has submitted a separate report on this activity.

Lastly, the Committee has attempted to move the annual sessions on economic education in the December meetings to a more analytical plane and to make them a forum for the exchange of information on carefully conducted experiments and measurement problems.

G. L. BACH, *Chairman*

REPORT ON A.E.A. VISITING SCIENTISTS PROGRAM

The Committee on Economic Education which assumed responsibility for supervising the A.E.A. Visiting Scientists Program, initiated during 1966–67 under a grant from the National Science Foundation, arranged with Phillip Saunders, of Carnegie-Mellon University, to serve as Program Director. At a meeting of the Committee in New York on September 16, 1966, it was decided that in selecting schools to be visited the Program Director should give first preference to: schools with no extensive graduate programs, certainly not beyond the master's level; schools geographically located in areas where they have no easy access to leading economists (applications from schools in major urban centers, for example, were not to be accepted); schools whose applications showed some imagination and thought as to how the visit would be effectively used; schools that were neither already of high excellence or had very low standards, on the assumption that visits to "in-between" schools would be most useful.

During 1966–67, these criteria were used to sponsor thirty-four days of visits at twenty different campuses by twenty different distinguished economists at a total cost of $4,676. The twenty visits covered campuses in fourteen different states from Florida to California and from Vermont to Louisiana. The first year of the program was felt to be quite successful by both the schools and the economists participating, as well as by the National Science Foundation.

At a meeting of the Committee on Economic Education in New York on September 8, 1967, it was decided to use the same criteria in the selection of schools for visits during 1967–68. As of December, 1967, twenty-two visits have been confirmed under the second-year program and another nineteen have been tentatively arranged. Most of these visits are scheduled for the spring term, so only fragmentary results are available concerning the second year program. Nevertheless, there is no evidence to indicate that the program will be any less successful than it was during 1966–67. Moreover, an enlarged budget of $6,540 should provide for a substantial increase in the number of visits.

PHILLIP SAUNDERS, *Program Director*

REPORT OF REPRESENTATIVE TO THE NATIONAL
BUREAU OF ECONOMIC RESEARCH

The National Bureau was organized in 1920 in response to a growing demand for objective determination of the facts bearing upon economic problems and for their interpretation in an impartial manner. It is a private nonprofit organization. Its Board of Directors includes men of different economic and social viewpoints with members from industry and labor, banking and finance, professional associations of economists, economic historians, accountants, and statisticians, and economists from university faculties. The American Economic Association is one of the representative organizations which nominate members of the National Bureau's Board of Directors.

While most of the Bureau's work is carried on by specialists, a few persons have had a marked influence in general on its nature and program. If one disregards the brief but important contribution of Dean Edwin Gay in the early years, two individuals have played major roles in the Bureau's development: Wesley C. Mitchell and Arthur F. Burns. The latter became a Research Associate in 1930, Director of Research in 1945, and President in 1956. Wishing to have somewhat reduced day-to-day responsibility, he was elected Chairman of the Board at the 1967 Annual Meeting. In March, 1967, John R. Meyer, Professor of Economics, Harvard University, was elected President and assumed his duties on August 1, 1967.

Staff and Conference Programs. Staff research in 1967 continued in the following areas: national income and wealth; economic growth; business cycles; prices, costs, and profits; labor markets; money, banking, and finance; governmental activity; and international economic relations. Among new studies started in 1967 were those on economics of health by Morris Silver, K. K. Ro, and Michael Grossman; business cycles and econometric models by Arthur F. Burns, Gergory Chow, and Geoffrey H. Moore; price and wage behavior by William D. Nordhaus; short-run changes in employment and hours in manufacturing by Sherwin Rosen; effect of prices and utilization rates on employment by Mohammed Nadiri; U.S. manufacturing abroad and U.S. exports by Robert E. Lipsey and Merle Yahr; urban economics by John F. Kain. An advisory committee was appointed to consider new studies in the field of social security and income maintenance.

The conference program included one sponsored by the Universities-National Bureau Committee for Economic Research on the Role of Agriculture in Economic Development (December, 1967), and two sponsored by the Conference on Research in Income and Wealth on the Size Distribution of Income and Wealth (March, 1967) and on Production and Productivity in the Service Industries (October, 1967). The following conferences are being planned: Production and Distribution of Public Products (April, 1968); Technology and Competition in International Trade (Octo-

ber, 1968); Education and Income (fall, 1968); Econometric Models of Cyclical Behavior (spring, 1969).

Fourteen reports resulting from the National Bureau's program were published in 1967 and seven others were in press in December. Of these twenty-one publications, ten are books by the staff, six are Occasional Papers by the staff, and five are books of conference proceedings. In addition, a summary by Helen Stone Tice of a 1966 conference sponsored by the Conference on Research in Income and Wealth on proposals for Revision of the United Nations System of National Accounts, was published in the *Review of Income and Wealth*, March, 1967.

Meetings of the Board of Directors in 1967. The 48th Annual Meeting of the National Bureau was held March 6, 1967, and the National Bureau's 47th Annual Report, "Contributions to Economic Knowledge Through Research," was presented to the Board. Copies of the report are available from the National Bureau upon request.

At the Annual Meeting, Frank W. Fetter was elected a Director at Large. Walter D. Fisher was elected Director upon nomination by Northwestern University, Douglas G. Hartle upon nomination by the University of Toronto, and Robert M. Solow upon nomination by Massachusetts Institute of Technology. Thomas D. Flynn was elected Director upon nomination by the American Institute of Certified Public Accountants, and Douglass C. North was elected Director upon nomination by the Economic History Association. Percival F. Brundage, Harry Scherman, and George Soule became Directors Emeriti.

A meeting of the Board was held November 10–11 to renew the current and planned research program. At this meeting, Henri Theil was elected Director upon nomination of the University of Chicago, to complete the term of Theodore W. Schultz, who had resigned. Also at this meeting the National Association of Business Economists was designated an additional representative organization nominating a member on the National Bureau's Board.

Officers elected at the 1967 Annual Meeting were Arthur F. Burns, Chairman and Acting President; Theodore O. Yntema, Vice Chairman; Donald B. Woodward, Treasurer; Geoffrey H. Moore, Director of Research; Douglas H. Eldridge, Executive Director and Secretary; and Hal B. Lary and Victor R. Fuchs, Associate Directors of Research.

Later in March, John R. Meyer, Professor of Economics, Harvard University, was elected to succeed Arthur F. Burns as President. Subsequently Mark S. Reinsberg was appointed to the new post of Director of Publications and Donald S. Shoup was appointed Assistant to the President.

Yoel Haitovsky, Technion-Israel Institute of Technology, Mohammed I. Nadiri, Northwestern University, and Sherwin Rosen, University of Rochester, were appointed research fellows for 1967–68.

WILLARD L. THORP

REPORT OF REPRESENTATIVE TO THE INTERNATIONAL ECONOMIC ASSOCIATION

In 1967 the International Economic Association held two conferences.

1. A conference on "Backward Areas in Advanced Countries" was held in Varenna, Italy, from August 28 to September 4. Papers were presented by economists from sixteen different countries. Participants from the United States were Benjamin Chinitz and Edgar M. Hoover. Paul Samuelson, the President of the I.E.A., was in attendance.

2. A conference of the East-West Committee on Labor Productivity, under the chairmanship of John Dunlop, was held in Talloires, France, from July 3 to July 9. Half of the participants came from Eastern European countries, including Russia. Participants from the United States were Abram Bergson, John T. Dunlop, Walter Galenson, and Hendrik S. Houthakker. Fritz Machlup, a member of the Council of the I.E.A., attended also.

Three meetings are planned for 1968. One will be an east-west conference on the subject, "Consumption, Planning, and Economic Growth." The second will be the triennial Congress in Montreal from September 2 to September 7 on "The Future of International Economic Relations." The third will be jointly sponsored with the Economic Analysis Unit of UNESCO to be held in December, 1968, on "The Role of Science and Technology in Economic Development."

Four volumes of the proceedings of earlier conferences were published during 1966–67, all in English. Another eight are being prepared for publication, five of them in English, three in French.

FRITZ MACHLUP

REPORT OF POLICY AND ADVISORY BOARD OF
THE ECONOMICS INSTITUTE

The tenth session of the Economics Institute was held at the University of Colorado from June 22 through August 26. It enrolled 117 students from 32 countries. These students are now engaged in graduate work in economics or agricultural economics in 49 different universities and colleges throughout the United States.

The Economics Institute provides eligible beginning foreign graduate students with intensive course work—offered at several levels—in economic theory, quantitative techniques, and English. This course work is supplemented by special lectures and seminar series dealing with the United States economy, and by field trips and social and recreational activities designed to acquaint the participants with the United States economy and campus and community life. The purpose is to help students strengthen their preparation and become familiar with United States academic procedures so they may carry on their graduate studies more productively and advantageously. The faculty of the Institute is recruited nationally. In 1967 the regular faculty included Professors Richard Bilas (Georgia State), Charles Meyer (Iowa State), Barry Poulson (Colorado), Robert Rezek (Illinois), James Worley (Vanderbilt). Visiting lecturers included William Baumol (Princeton), Richard Easterlin (Pennsylvania), Theodore Morgan (Wisconsin), Henry Rosovsky (Harvard), and Sidney Weintraub (Pennsylvania).

During 1967 a further grant request in support of the Institute was submitted to the Ford Foundation in the sum of $350,000. This grant will establish a revolving underwriting fund for the program plus a fellowship fund equivalent to approximately 12 percent of the annual budget. The remainder of costs will be collected from participants and their sponsors. The new grant is designed to underwrite the program for at least an additional five years. During this period the Institute will attempt to develop more direct and closer relationships with participating departments and sponsoring agencies, with respect both to the transitional training opportunity it offers and to the general problem of foreign student selection and evaluation.

The above grant request was supported by a detailed report on the Institute based on the results of its testing program and questionnaire surveys of past students and cooperating departments. Copies of this study have been forwarded to departmental chairmen. It has been published as a special bulletin by the Institute of International Education under the title, *Academic Orientation for Foreign Graduate Students: A Study of the Economics Institute.*

The next session of the Institute will be held at the University of Colorado from June 20 to August 24, 1968. Accommodations are being planned for 100 students. Further details may be obtained from the Director.

Members of the Policy and Advisory Board include the Director and six members of the profession appointed on three-year overlapping terms. In addition to the Director (Wyn F. Owen), the current membership (with appointment years) is Henry Rosovsky, Chairman (1965), Neil W. Chamberlain (1966), H. Gregg Lewis (1966), Raymond Mikesell (1965), Douglass North (1967), Simon Rottenberg (1965), and Vernon Ruttan (1967).

WYN F. OWEN

REPORT OF THE CENSUS ADVISORY COMMITTEE

The Census Advisory Committee of the American Economic Association met with the Director and Staff of the Bureau of the Census on January 19, 1967.

The Committee reviewed the Bureau's plans for the 1970 Censuses of Population and Housing and other existing programs and offered suggestions for their improvement designed to reflect the nation's data needs in helping to meet its economic and social problems.

The Committee discussed the recommendations and findings of the "Report of the Task Force on the Storage of and Access to Government Statistics" (the Kaysen Committee Report), and their implications for Census Bureau and federal statistical activities in general. Although the Bureau noted that the condition of existing statistical records of the various government agencies and the present state of computer technology would not permit the immediate matching of most of these records and allow for the matching of others only at a very high cost, the Bureau indicated that it is continuing efforts to make its data more cheaply accessible to outside users. The Committee, while recognizing these technical problems, urged that work should continue to reduce the lack of comparability between many government statistics now published. The Chairman of the Committee recommended that the Bureau should continue to seek more money for collection and compilation of social science data.

The Bureau described to the Committee their plans to develop a long-range planning program based on the Planning-Programming-Budgeting (PPB) system analysis which the President has proposed for use throughout the government. The Bureau noted that such planning will help to make its programs more responsive to the nation's current and future statistical needs.

Several Committee members suggested that the need for more data on the problems of inflation could be met, in part, by the Bureau's development of "indicators of inflation," to be published as part of its Business Cycle Developments report, or in a similar separate publication.

SOLOMON FABRICANT, *Chairman*

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL
DIVISION OF BEHAVIORAL SCIENCES

The Association appoints three representatives, each for a three-year term, to the Behavioral Sciences Division of the National Research Council. The Division is a relatively recent symbol of the acceptance of the social sciences as science. The function of the various divisions of the National Research Council is primarily the providing of expert advice and guidance to the government. This generally takes the form of appointing special *ad hoc* committees to prepare reports. Expenses are funded in various ways, but the economists who serve do so without compensation, in the belief that this somehow reduces problems of conflict of interest and makes the advice more impartial. Some currently active committees of interest to economists are: Committee on International Relations in the Behavioral Sciences (Lawrence R. Klein is a member); Committee on Government Programs in the Behavioral Sciences (Thomas C. Schelling and Joseph J. Spengler are members); Behavioral and Social Science Survey Committee (with panels in each of the major disciplines, the economic one chaired by Carl Kaysen and Robert M. Solow); Committee on Information in the Behavioral Sciences (Richard Ruggles is a member); Advisory Committee to H. U. D. on Social and Behavioral Urban Research (just being formed); and Committee on Biological Research, Social Behavior, and Social Policy (just being formed).

The Division also provides advice and consultation in the formation of other groups, such as the National Science Foundation's recently formed Commission on the Social Sciences, and seeks directly to identify problems important to the development of science and/or to the national welfare.

The current Chairman of the Division is Kingsley Davis. For the next two years, starting June, 1968, the Chairman will be Professor Herbert Simon, of Carnegie-Mellon University.

JAMES N. MORGAN, *Program Director*

PUBLICATIONS

OF THE

AMERICAN ECONOMIC ASSOCIATION

1968

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NEW SERIES

THIRD SERIES

Note—During 1896-1899 the Association issued its publications in two series, viz., the bimonthly Economic Studies, and the "New Series" of larger monographs printed at irregular intervals. In 1900 it reverted to the policy of issuing its monographs, now called the "Third Series" of the publications, at quarterly intervals.
Price per volume, $4.00.

Volume III, 1902

1. **Fourteenth Annual Meeting: Papers on International Trade; Industrial Policy; Public Finance; Protective Tariff; Negro Problem; Arbitration of Labor Disputes in Coal Mining Industry; Porto Rican Finance; Economic History. Pp. 400. $1.50
2. **The Negro in Africa and America. By Joseph A. Tillinghast. Pp. 240.   1.25
3. Taxation in New Hampshire. By M. H. Robinson. Pp. 232.   1.25
4. **Rent in Modern Economic Theory. By Alvin S. Johnson. Pp. 136.   .75

Volume IV, 1903

1. Fifteenth Annual Meeting: Papers and Discussions on Economic and Social Progress; Trade Unions and the Open Shop; Railway Regulation; Theory of Wages; Theory of Rent; Oriental Currency Problem. Pp. 298.   1.25
2. Ethnic Factors in the Population of Boston. By F. A. Bushee. Pp. 171.   1.00
3. History of Contract Labor in the Hawaiian Islands. By Catharine Coman. Pp. 74.   .75
4. **The Income Tax in the Commonwealth of the United States. By Delos O. Kinsman. Pp. 134.   1.00

Volume V, 1904

**Sixteenth Annual Meeting. Papers and Proceedings published in two parts.
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